# Oral Abstracts

ACVAA

## Ultrasound-guided ischiorectal fossa block targeting the pudendal nerve in dogs: a cadaveric study

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The objective of this prospective, randomized, anatomic study was to describe an ultrasound-guided (USG) regional anesthesia technique for perineural injection of the pudendal nerve (PdN) in dogs.

A total of seven thawed and 15 fresh canine cadavers were used. Anatomical dissection, sonography and computed tomography (CT) techniques were used. Seventeen cadavers (11 males and six females), with body mass of 25.2 ± 6.3 kg (mean ± standard deviation) were used: four for anatomical study and approach development and 13 administered bilateral USG transgluteal injections. Using a dorsomedial-to-ventrolateral needle trajectory, the ischiorectal fossa was targeted medial to the ischiatic spine. Each hemipelvis was randomized to be administered high (HV, 0.2 mL $kg^{-1}$) or low (LV, 0.1 mL $kg^{-1}$) volume injections of ropivacaine-dye solution. Following injection, cadavers were dissected. Successful PdN staining (>1 cm nerve length stained) and inadvertent staining of the sciatic nerve, or rectal, urethral or intravascular puncture was recorded. Volumes were compared using a mixed effects ordinal logistic regression model ($p < 0.05$ considered significant).

We excluded five cadavers owing to poor tissue preservation. The neurovascular bundle containing PdN and landmarks for ischiorectal fossa were defined using CT. Sonographically, landmarks were identified and dye solution injected into the fossa. Complete staining of the PdN was achieved in 69.2% (HV) and 58.3% (LV) of injections. There was no significant difference in nerve staining between groups ($p = 0.864$). There was no significant difference in sciatic nerve staining between HV (7.7%) and LV (8.3%) ($p = 0.71$). Rectal, urethral or intravascular puncture was not observed.

This is the first description of an USG ischiorectal fossa block using a transgluteal approach targeting the PdN in dogs. The described USG technique could provide anesthesia of the urethra and perineal region. Further studies are necessary to investigate this approach in live animals.

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# The sedative and cardiovascular effects of oral transmucosal acepromazine in dogs

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Oral transmucosal (OTM) administration of injectable acepromazine is recommended for pre-admission sedation in fearful and aggressive dogs (Costa et al. 2019). The effects of OTM acepromazine have not yet been demonstrated. Our aim was to evaluate the sedative and cardiovascular effects of OTM injectable acepromazine

Single centre, prospective, randomised, blinded-controlled clinical trial. 28 client-owned healthy adult dogs undergoing elective surgical procedures were included. Patients were randomised into treatment group: OTM injectable acepromazine 2 mg $ml^{-1}$, 0.05 mg $kg^{-1}$ or control group: equivalent OTM volume of water. Baseline HR, non-invasive blood pressure (NIBP) and sedation score (Hofmeister et al. 2010) were obtained prior to administration and repeated one hour later. Non-parametric data was analysed using Mann-Whitney and Wilcoxon Rank tests; parametric data was analysed using Student's t test.

OTM acepromazine significantly increased post-treatment sedation score compared to the control group (Table 1). Between groups, OTM acepromazine significantly decreased HR, SAP, MAP and DAP (Table 1).

OTM acepromazine significantly increases sedation score and decreases HR and NIBP. These findings support the administration of OTM acepromazine for pre-hospital sedation in dogs.

**References**

Costa RS., Karas AZ., Borns-Weil S. (2019) Chill protocol to manage aggressive & fearful dogs. Clin Brief 2:63-65.

Hofmeister EH., Chandler MJ., Read MR.(2010) Effects of acepromazine, hydromorphone, or an acepromazine-hydromorphone combination on the degree of sedation in clinically normal dogs. (Correction published in J Am Vet Med Assoc. 2011; 238[2]:182). J Am Vet Med Assoc. 237(10):1155-1159.

**Table 1: Sedation Score and Cardiovascular Variables**

| Parameter | Group | Pre-treatment Median (Range) | P value | Post-treatment Median (Range) | P value |
|---|---|---|---|---|---|
| Sedation score | ACP | 0 (-3 – 3) | 0.225 | 7 (-5 – 3) | <0.001 |
| | Control | -0.5 (-3 – 2) | | 0 (5 – 12) | |
| | | Pre-treatment Mean +/- SD | | Post-treatment Mean +/- SD | |
| HR (bpm) | ACP | 112.9 (+/- 22.1) | 0.62 | 92.6 (+/- 22.5) | 0.022 |
| | Control | 117.4 (+/- 26.0) | | 113.1 (+/- 22.2) | |
| MAP (mmHg) | ACP | 112.6 (+/- 19.0) | 0.389 | 96.8 (+/- 16.5) | 0.01 |
| | Control | 118.7 (+/- 18.2) | | 114.4 (+/- 17.1) | |
| SAP (mmHg) | ACP | 146.8 (+/- 21.5) | 0.304 | 120.1 (+/- 17.4) | 0.001 |
| | Control | 151.0 (+/- 20.7) | | 141.2 (+/- 16.6) | |
| DAP (mmHg) | ACP | 86.7 (+/- 17.5) | 0.05 | 74.1 (+/- 13.1) | <0.001 |
| | Control | 99.0 (+/- 20.6) | | 93.9 (+/- 15.5) | |

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# Cardiorespiratory and anesthetic effects of morphine or dexmedetomidine in sheep undergoing videolaparoscopic ovariectomy

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This study compared cardiorespiratory and anesthetic effects of dexmedetomidine and morphine in sheep anesthetized with propofol for videolaparoscopic ovariectomy.

Eleven adult Santa Inês ewes (53.3 ± 7.9 kg) were randomly assigned to two groups: DEX group (n = 5) received 5 μg $kg^{-1}$ of dexmedetomidine IM, and MOR group (n = 6) received 0.2 mg $kg^{-1}$ of morphine IM, ten minutes before surgical incision. Animals were premedicated with diazepam (0.25 mg $kg^{-1}$ IV), followed by induction with propofol (IV to effect), and maintenance with propofol constant rate infusion, adjusted according to anesthetic depth. Sheep were ventilated with positive pressure ($FiO_2$ = 1), VT set at 8 - 10 mL $kg^{-1}$, peak inspiratory pressure limited to 20 $cmH_2O$, and *f*r adjusted to maintain normocapnia. Recordings of HR, *f*r, $SpO_2$, invasive MAP, SAP and DAP, arterial blood gases, and pH were carried out at baseline and predetermined time points. Sheep were positioned in 45º Trendelenburg with pneumoperitoneum. Data were analyzed using descriptive statistics, Shapiro-Wilk normality test, unpaired t-test, two-way mixed ANOVA, and Sidak's test ($p \leq 0.05$).

In DEX, HR was significantly lower at 60 (67 ± 16 beats $minute^{-1}$) and 75 minutes (52 ± 2 beats $minute^{-1}$) of anesthesia, compared to baseline and to MOR. There was a significant increase over time in $PaO_2$ within both groups, without differences between them. No significant differences were found between groups regarding SAP, MAP, DAP, *f*r, $ETCO_2$, $SpO_2$, and blood gas parameters. Propofol requirement (0.5 ± 0.1 mg kg $min^{-1}$) and standing times (49.9 ± 16.6 minutes) were similar between groups. However, extubation time was significantly longer in DEX (14.2 ± 2.8 minutes) than MOR (9.2 ± 1.9 minutes). No adverse effects were registered.

Dexmedetomidine and morphine induced minimal cardiorespiratory changes in sheep. Morphine resulted in shorter extubation times.

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# Investigating the efficacy of pregabalin, compared to gabapentin, at facilitating intravenous access and producing anxiolytic effects in cats

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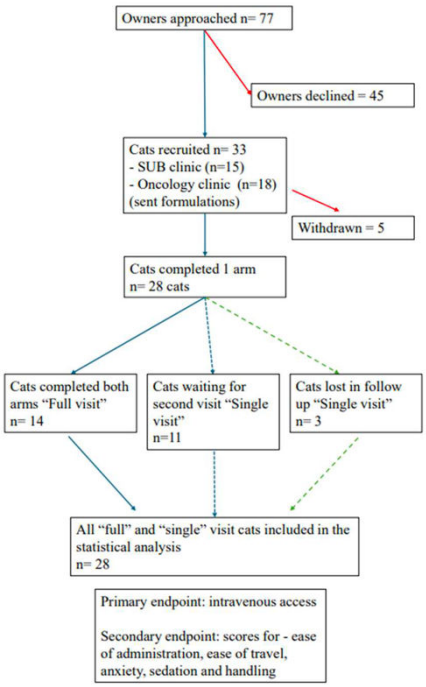
Anxiety in cats in clinical environments is a concern for veterinary professionals and clients (Taylor et al, 2022). Gabapentin is widely used, producing mild sedation and anxiolysis. Pregabalin (Bonqat) is a newly licensed liquid option, which may be easier to administer and can be dosed accurately.

In a prospective randomised blinded two period crossover study, cats that previously required gabapentin and needed two visits for veterinary intervention were recruited. Cats were randomised to start the study with gabapentin, based on their previously administered dose (50 or 100 mg), or pregabalin (5 mg $kg^{-1}$) with minimum 7-day washout period between treatments. We hypothesised that pregabalin will facilitate intravascular access and provide comparable anxiolysis similarly to gabapentin. Primary endpoint: successful intravenous access. Secondary endpoints included: ease of administration and transport (owner); handling, sedation and anxiety scores (blinded assessors). A generalised linear mixed model was conducted to examine the effect of treatment on outcomes. The model used binomial distribution with a logit link and pairwise comparison to estimate the difference in probability. In the gabapentin period, the effect of dose (mg $kg^{-1}$) was evaluated between the upper and lower quantiles.

Thirty-three cats were recruited; 28 were included in the analyses (Figure 1). Probability of successful vascular access was 73.7% and 69.3% for gabapentin and pregabalin, respectively (difference 4.3%, CI [-26.2 - 34.9%]). There was no difference in probability of secondary endpoint scores between treatments. Median dose of gabapentin was 19.6 mg $kg^{-1}$ (range 10.5 - 33.3 mg $kg^{-1}$), with no difference on any outcomes based on dose given. Side effects included vomiting (pregabalin = 3), hypersalivation (gabapentin = 2; pregabalin = 1) and ataxia (gabapentin = 1).

At this stage, we could not detect a difference between pregabalin and gabapentin to facilitate intravenous catheterisation, or with anxiolysis.

Figure 1: CONSORT diagram outlining recruitment to analysis.



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4722

# Dexmedetomidine post-conditioning improves cardiovascular function and maintains normal renal parameters in anesthetized, experimentally endotoxemic horses

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Dexmedetomidine infusions have shown benefits in anesthetized endotoxemic horses when administered concurrent to endotoxin but post-conditioning effects are unknown.

Ten systemically healthy horses donated for euthanasia for reasons other than acute gastrointestinal disease (e.g. advanced osteoarthritis) were instrumented for acquisition of cardiac index (CI) using saline thermodilution. All horses received IV Escherichia coli O55:B5 lipopolysaccharides (LPS) (0.1 µg $kg^{-1}$) while awake immediately prior to anesthesia. Horses randomly assigned to the control group (LPS; n = 5) received IV xylazine (1 mg $kg^{-1}$) and those assigned to treatment group (LPS-Dex; n = 5) received IV dexmedetomidine (0.005 mg $kg^{-1}$) prior to induction with IV ketamine (2.2 mg $kg^{-1}$) and midazolam (0.05 mg $kg^{-1}$) and maintenance with sevoflurane in oxygen and dexmedetomidine 1.75 µg $kg^{-1}$ $hr^{-1}$ only in LPS-Dex (target FE'Sevo 3% LPS, 1.8% LPS-Dex). Cardiopulmonary, acid-base, and creatinine values were obtained every 30 minutes until euthanasia at 180 minutes. Data were compared between groups using mixed model analysis ($p < 0.05$).

Overall FE'Sevo was 36% lower in group LPS-Dex. Acid-base values were similar between groups. Mean ± standard deviation mean arterial pressure was significantly higher in LPS-Dex at 30 minutes (84 ± 18 mmHg LPS-Dex versus 52 ± 7 LPS) and CI significantly higher in LPS-Dex at 30 and 60 minutes post-induction (57.9 ± 15.6 mL $minute^{-1}$ $kg^{-1}$ LPS-Dex versus 43.1 ± 9.4 LPS 30 minutes; 60.2 ± 11.8 mL $minute^{-1}$ $kg^{-1}$ LPS-Dex versus 38.9 ± 11.2 LPS 60 minutes). Creatinine was elevated and significantly higher in LPS from 60 minutes onward but remained normal in LPS-Dex throughout (201 ± 38 µmol $L^{-1}$ LPS versus 124 ± 26 LPS-Dex 180 minutes).

Dexmedetomidine infusion with equipotent sevoflurane concentration provided early cardiac function benefit and maintains normal creatinine levels in anesthetized horses even when administered after the onset of endotoxemia.

4725

# Population pharmacokinetics of IV paracetamol: Do all dog breeds process the drug similarly?

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The use of intravenous (IV) paracetamol in dogs is increasing, however, no licensed product exists. A drug development programme is needed to establish safe and effective dosages. This study aims to i) describe population pharmacokinetics (PK) of paracetamol in a large population of dogs and evaluate the effect of covariates ii) perform Monte-Carlo simulations to explore the adequacy of current dosage regimens to achieve putative plasma concentrations associated with analgesia.

Studies referencing IV paracetamol PK in dogs were selected, and raw plasma concentration-time data were obtained. Non-linear-mixed-effects model (Monolix) estimated PK parameters and explored covariate effects. *In silico* Monte-Carlo simulations evaluated the percentage of the inter-dose interval where plasma concentration exceeded target of 1 µg $mL^{-1}$ at steady state.

A total of 1095 plasma-concentration from 7 studies were modelled. Seventy-seven dogs (31 beagles, 21 greyhound, 6 labradors and 19 various-breeds) received doses from 0.2 to 20 mg $kg^{-1}$. A two-compartment population PK model, with breed and anaesthesia as significant covariates, best described the data. The typical clearance of paracetamol was medium to fast (1.241 $L^{-1}$ $kg^{-1}$ h) in Beagles/various breeds. Clearance was 68.3% and 29.6% lower in Labradors (0.393 $L^{-1}$ $kg^{-1}$ h) and Greyhounds (0.874 $L^{-1}$ $kg^{-1}$ h), respectively compared to the reference population. Anaesthesia increased intercompartmental clearance from 0.146 to 0.232 $L^{-1}$ $kg^{-1}$ h. Steady-state volume of distribution was 1.51 L $kg^{-1}$. Monte Carlo simulations predicted that with 20 mg $kg^{-1}$ every 8 hours, Labradors would maintain plasma-concentrations above the target for 89% of the dosing period compared to 49% for Greyhounds and 35% for Beagles/various-breeds.

IV paracetamol PK varied between dog breeds. The clearance of paracetamol is remarkably different in Labradors compared to other breeds, but this finding needs confirming with a larger population. Further research is needed to optimise dosage recommendations and understand the origin of breed-specific-differences.

4751

# Pharmacokinetics and pharmacodynamics of an extended duration transdermal buprenorphine in dogs

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An extended-duration transdermal formulation of buprenorphine has recently become available in the United States for feline post-operative pain management. It reportedly provides analgesic effects for up to four days following a single topical application. The purpose of this study was to assess the pharmacokinetics and pharmacodynamics of this extended-duration transdermal buprenorphine in dogs.

Sixteen clinically healthy dogs were included in this study and were randomly assigned to one of four groups. Dogs in groups QL, HL, L, and M received transdermal buprenorphine at doses of 0.68 mg kg-1, 1.35 mg $kg^{-1}$, 2.7 mg $kg^{-1}$, and 4.7 mg $kg^{-1}$, respectively. Blood samples were collected for pharmacokinetic analysis, and sedation scores, behavioral changes, rectal temperature, HR, and *fr* were assessed prior to application of buprenorphine and at 30 minutes, 1, 2, 4, 8, 12, 24, 48, 72, 96, and 168 hours following application. Plasma samples were analyzed using ultra-high-pressure liquid chromatography followed by detection with tandem mass spectrometry.

The median (range) for the maximum plasma buprenorphine concentrations (Cmax), the time to maximum concentration (tmax), and the area under the plasma concentration-time curve (AUC) were 8 (2-72) hours, 6.9 (2.2 - 15.2) ng $mL^{-1}$, and 170.5 (68.7 - 761.8) h*ng $mL^{-1}$, respectively. The plasma concentrations were so variable that pharmacokinetic analysis could not be reliably performed in many of the dogs. Adverse effects observed included decreased appetite (35.7%), dysphoria (whining) (35.7%), hypersalivation (28.6%), diarrhea (21.4%), regurgitation (14.3%), and vomiting (7.1%). No signs of skin reaction at the application site were noted.

A single administration of transdermal buprenorphine produced highly variable pharmacokinetic profiles and was associated with some clinical adverse effects in healthy dogs without concurrent pain.

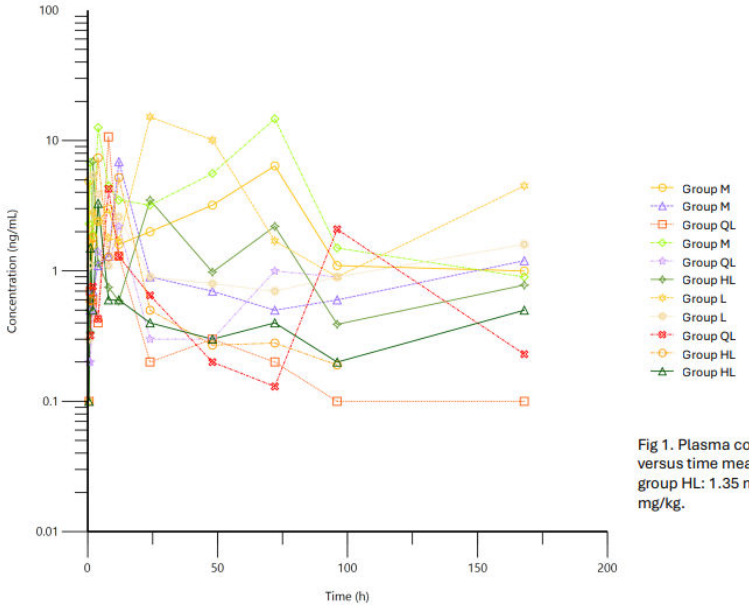


Fig 1. Plasma concentration of transdermal buprenorphine versus time measured in 11 dogs. Group QL: 0.68 mg/kg; group HL: 1.35 mg/kg; group L: 1.35 mg/kg; group M: 4.7 mg/kg.

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# Effect on mechanical nociceptive threshold of intravenous or intramuscular morphine in healthy donkeys

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Intravenous morphine (0.5 mg $kg^{-1}$) increased the mechanical nociceptive threshold (MNT) in donkeys (Maney et al. 2023). The effects after administration by the IM route has not been investigated.

Six adult female donkeys were enrolled in a randomized, blinded, crossover, experimental study. Three separate treatments [IM and IV saline, IM saline and IV morphine (0.5 mg $kg^{-1}$), IV saline and IM morphine (0.5 mg $kg^{-1}$)] were administered. An algometer applied an increasing force (2 N/sec) on the dorsal metacarpus. The force was discontinued and recorded at the time of positive response (leg lift) or when 25.0 N was reached. An average baseline MNT was determined in triplicate before injections and at 15, 30, 45, 60, 90, 120, 150, 180, 210, 240, 300, 420, and 480 minutes post-injections. Gut sounds, HR, and fr were recorded. A mixed-effects model for repeated measures, followed by Tukey's test, were used to compare values within groups and among time points in each group. Significance level was set to 5% (Figure 1).

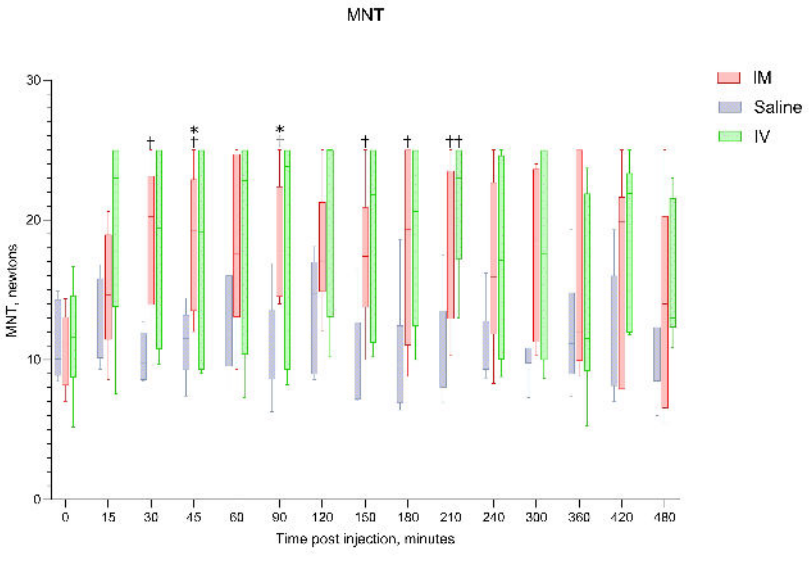
The median MNTs increased above baseline after administration of morphine and were statistically different at 45 and 90 minutes after IM administration. Compared to saline, statistical differences in MNTs occurred at 210 minutes after IV administration and at 30, 45, 90, 150, 180, and 210 minutes after IM administration. The threshold of 25.0 N was reached for 28/90 and 13/90 measurements after IV and IM administration respectively. After morphine administration, borborygmi temporarily ceased in all animals and returned in 5/6 animals by 480 minutes. No adverse events were noted.

Morphine administered IM provided antinociception for a longer period than administered IV. Higher MNTs were reached with IV administration.

Figure 1: Median (min and max) MNT difference in 6 jennies administered saline, morphine IM, or morphine IV. *Different from treatment baseline. †Different from saline treatment.

**Reference**

Maney JK., Dzikiti BT, Escobar A et al. (2023) Morphine in donkeys: Antinociceptive effect and preliminary pharmacokinetics. Equine Vet J 55, 1086-1093.



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# Reliability of myotonometry in equine myofascial pain syndrome and effects of ischemic compression therapies

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This study aimed to evaluate the reliability of muscle stiffness measurements using the MyotonPro® device at myofascial trigger points (MTrPs) in horses, and to assess the effectiveness of two ischemic compression techniques—continuous and discontinuous—on these points.

A randomised, blinded, cross-sectional study was conducted on twelve horses aged 11.9 [6–19] years showing no signs of apparent pain. MTrPs were identified by manual palpation. Muscle stiffness was measured at control points and MTrPs using the MyotonPro® (Roch et al., 2020). Each horse received both continuous (90 seconds) and discontinuous (three times 30 seconds) ischemic compression, randomly assigned to two different MTrPs. Measurements were taken before and after each treatment to evaluate the effects on muscle mechanical properties. Linear mixed-effects models were used to analyse the variation in muscle stiffness, with horses and trigger point positions treated as random effects.

The methodology allowed for precise differentiation between treatment effects at different muscle sites. Muscle stiffness at MTrPs (489 ± 30 N $m^{-1}$) was significantly higher than at control points (360 ± 18 N $m^{-1}$), with a mean difference of approximately 128 ± 23 N $m^{-1}$. The caudal MTrPs showed greater stiffness compared to cranial ones (155 ± 24 N $m^{-1}$ vs 101 ± 24 N $m^{-1}$). Continuous compression did not significantly change stiffness. However, discontinuous compression unexpectedly increased muscle stiffness by approximately 28 ± 6 N $m^{-1}$.

These findings support the MyotonPro® as a reliable tool for measuring muscle mechanical properties in horses. The differential response to ischemic compression techniques highlights the complexity of treating myofascial trigger points. Further studies combining myotonometry with imaging or oximetry are needed to understand the functional impact of these changes and to improve treatment approaches.

**References**

Roch, M., Morin, M., Gaudreault, N. (2020). The MyotonPRO: A reliable tool for quantifying the viscoelastic properties of a trigger point on the infraspinatus in non-traumatic chronic shoulder pain. Journal of Bodywork and Movement Therapies, 24(3), 379–385.

4770

# Standing sedation in horses and ponies: perioperative fatalities in a worldwide observational, prospective, multicentre cohort study

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Information regarding the mortality associated with standing procedures in horses is sparse. We report preliminary data from > 10,000 standing sedations.

Approved by the Ethical Committee of the Association of Veterinary Anaesthetists (2020-009), this confidential, observational, prospective, multicentre cohort study collected records of horses and ponies undergoing standing sedation (SS) for surgery or advanced imaging using continuous rate infusions (CRIs) or at least one additional "top-up". Procedures were classified as "NON-COLIC" or "COLIC". Outcome at seven days was recorded as i) "ALIVE", ii) "EUTHANASIA" or iii) "DEAD" (Johnston et al. 2002; Gozalo-Marcilla et al. 2025). Data were collected with a PDF questionnaire, which evolved into a webpage, (Domenech et al. 2024) and processed with the statistical software R.

Data were collected from 12,307 SS in 61 centres within 23 countries. Death rates were 0.2% overall (19/12,307), 0.1% for cases classified as NON-COLIC (16/12,237) and 4.3% for COLIC (3/70). For the NON-COLICs (16 deaths from 12,237 NON-COLICs), the causes of death were abdominal in nine (56.25%), (re-)fractures in four (25.0%), two were "found dead" (12.5%) and one (6.25%) for "other reasons". Premedication was usually based on combinations of alpha-2-agonists/opioids ± acepromazine (83.3%). Sedation was maintained using "top-ups" (78.6%), CRI (30.8%) or CRI + top-ups (9.4%). For "top-ups", detomidine was the most common alpha-2-agonist (77.8%) and butorphanol the most common opioid (88.4%). For CRI, detomidine was the most common alpha-2-agonist (88.3%), and butorphanol (53.8%) or morphine (45.1%) the most common opioids. Loco-regional anaesthesia was performed in 37.6% of the cases. Monitoring was minimal, with temperature, ECG and pulse-oximetry used in 5.8%, 3.8% and 0.9% of the patients, respectively.

Standing sedation in horses is not risk free. Even without the complications associated with GA which generally occur during recovery, horses still die unexpectedly within seven days of sedation alone.

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# Comparison of medial and lateral ultrasound-guided approaches to RUMM (radial, ulnar, median, and musculocutaneous) nerve injections in rats

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The objective of this study was to evaluate nerve length staining after a medial or lateral RUMM ultrasound-guided approach in rat cadavers. The hypothesis tested was that the medial approach would result in greater length of staining.

Ten Wistar rat cadavers were used. Each rat received a medial or lateral RUMM injection in both thoracic limbs. For the lateral approach, a 19–5 MHz linear ultrasound probe was positioned over the triceps region at the proximal third of the brachium, perpendicular to the longitudinal axis of the humerus. For the medial approach, the same probe was positioned at the proximal third of the humerus over the superficial pectoral and biceps brachii muscles. A 25-gauge echogenic needle was inserted in-plane from a caudal-to-cranial direction, targeting the neurovascular sheath and the musculocutaneous nerve located outside the fascia. A 0.1 mL bupivacaine-dye solution was injected, equally divided between the neurovascular sheath and the musculocutaneous nerve. Gross dissection was performed, and the length of nerve staining was measured. A two-tailed t-test was used to compare staining of the radial, ulnar, and median (RUM) nerves and a Mann-Whitney test was used to compare staining of the musculocutaneous nerve with significance of $p < 0.05$.

Length of RUM staining was greater for the medial approach (10.4 ± 1.0 mm) compared to the lateral approach (6.7 ± 0.5 mm) ($p < 0.001$). There was no difference between the two approaches for the musculocutaneous nerve, medial, 5 mm (IQR: 4.7–6 mm); lateral, 5.5 mm (IQR: 5–6 mm)] ($p = 0.72$). One musculocutaneous nerve did not stain in the lateral approach.

In conclusion, the medial approach achieved a longer RUM but not musculocutaneous nerve staining compared to the lateral approach.

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# Evaluation of sedative and cardiovascular effects of medetomidine-vatinoxan and hydromorphone for premedication in dogs undergoing patent ductus arteriosus closure – Preliminary data

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While medetomidine-vatinoxan causes sedation with limited cardiovascular effects (Rolfe et al. 2012), its use for premedication in dogs with patent ductus arteriosus (PDA) has not been evaluated.

In this blinded randomized prospective clinical study, 23 dogs (2 - 72 months old; 1.1 - 22.2 kg) undergoing PDA closure were premedicated intramuscularly with hydromorphone (0.1 mg $kg^{-1}$; H group) with or without medetomidine-vatinoxan (0.125 mg $m^{2-1}$; HMV group). Behavioral (0 – 21 scale, 21 = extremely agitated), sedation (6 – 24 scale, 24 = not sedated), reaction to preparation (trichotomy and antisepsis) for IV catheterization (0 – 36 scale, 36 = extremely reactive), and IV catheterization scores (1 – 4 scale, 4 = extremely reactive), as well as HR, and blood pressure were obtained before and after premedication. Wilcoxon signed-rank test, Mann-Whitney U test, and t-tests were used ($p < 0.05$ considered significant).

Compared with the H group, the HMV group had lower scores (median [range]) for behavior (3 [2 – 12] vs 0 [0 – 5]; $p < 0.001$), sedation (20 [14 – 15] vs 15 [16 – 19]; $p = 0.004$), and preparation for IV catheterization (6 [2 – 16] vs 0 [0 – 5]; $p < 0.001$), as well as (mean ± SD) SAP (134 ± 22 vs 109 ± 24 mmHg; $p = 0.019$), DAP (64 ± 20 vs 45 ± 11 mmHg; $p = 0.027$), and MAP (92 ± 19 vs 63 ± 13 mmHg; $p = 0.002$) after premedication. No significant HR differences were observed between groups (H, 112 ± 30 beats $minute^{-1}$; HMV, 113 ± 42 beats $minute^{-1}$). Despite initial blood pressure reduction after premedication in the HMV group, SAP remained within the normal range (Grubb et al. 2020), with no significant HR differences between groups

The addition of medetomidine-vatinoxan to hydromorphone enhanced sedation, facilitating pre-anesthetic preparation for IV catheterization in dogs with PDA.

## References

Rolfe NG, Kerr CL, McDonell WN (2012) Cardiopulmonary and sedative effects of the peripheral α2-adrenoceptor antagonist MK 0467 administered intravenously or intramuscularly concurrently with medetomidine in dogs. Am J Vet Res 73:587–94.

Grubb T, Sager J, Gaynor JS et al. (2020) 2020 AAHA Anesthesia and monitoring guidelines for dogs and cats. J Am Anim Hosp Assoc 56:59–82.

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# Effect of the rectus abdominal sheath block with 0.2% bupivacaine in anesthetized horses on anesthesia recovery

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Following rectus abdominal sheath (RAS) block in dorsally recumbent anesthetized horses, dorsal spread of local anesthetic toward the femoral nerve is a concern for complications during recovery.

Six healthy horses were anesthetized twice using a standardized protocol. In a crossover design, 1 mL kg-1 of either 0.9% NaCl (ST) or 0.2% bupivacaine (BT) was injected bilaterally into the RAS using a 2-point ultrasound-guided technique. Horses remained anesthetized for one hour post-block before recovery. Duration of anesthesia and fraction of expired isoflurane (Fe'isoflurane) were recorded. Recovery variables included times for first movement, sternal recumbency, and standing, accelerometry-derived recovery score (RS), and number of standing attempts. Paired t-tests were used for parametric data (mean ± standard deviation), and Wilcoxon signed rank tests for non-parametric data (median [range]). Alpha was set at 5%.

Anesthesia conditions were similar between ST and BT with durations of 98 ± 5 and 93 ± 5 minutes and Fe'isoflurane of 1.18 ± 0.15 and 1.23 ± 0.18% ($p > 0.181$). Times to first movement, sternal recumbency, and standing were 25 ± 11 and 35 ± 19, 51 ± 21 and 57 ± 25, and 52 ± 21 and 60 ± 29 minutes, for ST and BT respectively. RS and standing attempts were 25.6 ± 9.2 and 24.2 ± 9.1, and 1 [1, 2] and 1 [1, 3], for ST and BT respectively. Recovery parameters were not significantly different ($p>.366$) between treatments.

The RAS block with bupivacaine did not affect recovery quality under the conditions studied.

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# Comparison of gabapentin and carprofen for the treatment of acute orthopedic surgical pain in dogs undergoing tibial plateau leveling osteotomy

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Gabapentin is often prescribed for acute post-operative analgesia in dogs. The study objective was to determine if gabapentin alone or in combination with carprofen provides analgesia in the late post operative period after elective orthopedic surgery.

This was a prospective, randomized, double-blinded, placebo-controlled clinical trial with thirty-one dogs undergoing tibial plateau leveling osteotomy (TPLO) using a standardized anesthetic and immediate post-operative pain protocol. Patients randomly received: gabapentin 20 mg kg-1 every 8 hours plus placebo every 12 hours, gabapentin 20 mg kg-1 every 8 hours plus carprofen 2.2 mg kg-1 every 12 hours, or carprofen 2.2 mg kg-1 every 12 hours plus placebo every 8 hours starting the night prior to surgery and continuing for 2 weeks. Assessment included pain utilizing the Glasgow Composite Pain Scale and limb function with low-profile pressure measurement the day prior to surgery, and up to fourteen days after surgery. Data were analyzed using mixed effects ordinal logistic regression models.

Pain scores for all groups peaked at 24 hours after surgery [3 (1-6); median (range)] and returned to baseline by 2 days after surgery [1 (1-3)]. There was no significant difference in pain scores among groups at any time point, in the percent decrease of maximum force across time or among treatment groups, and there were no time-treatment interactions that influenced maximum force.

Gabapentin alone or in combination with carprofen did not result in improvement in pain scores or limb function compared to carprofen alone for dogs undergoing TPLO surgery.

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# Chloroprocaine-lidocaine pain-selective local anesthesia in rats is interval dependent

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Pain selective local anesthesia can be achieved by selective permeation of a charged local anesthetic, via TRPV1 channels. We examined whether combining chloroprocaine a local anesthetic with high PkA, with lidocaine, a TRPV1 agonist, would provide pain-selective anesthesia.

Forty eight male HSD rats weighing 200-224gr were randomly divided into 8 groups. A sciatic nerve block was performed with 0.1 ml chloroprocaine 0.5% (Chl) or a saline control (Sal), followed immediately (Sim) or with a ten-minute interval (TMI) with either Lidocaine 2% (-Lid), or a saline control (-Sal). Thermal paw withdrawal latency (PWL) mechanical pain threshold (MPT), and motor function were assessed by a blinded evaluator at baseline, and 15, 30, 60, 120 ,180, and 240 minutes after injections. PWL and MPT were normalized to baseline and contralateral limb for each animal. Effects of treatment were assessed using ANOVA with post hoc analysis.

Motor score was significantly different than Sal-Sal for all animals that received Lidocaine at 15 and 30 minutes, and for Chl-Lid TMI also at 60min ($p < 0.005$). PWL at 30 min was different than Sal-Sal only for Chl-Lid for both Sim and TMI ($p < 0.005$). PWL in Chl-Lid was higher for TMI than for Sim at 15 ($p < 0.005$) and 60 minutes ($p < 0.02$). No difference was observed for MPT between Chl-Lid and Sal-Lid.

Pain selective blockade using Chl-Lid was not demonstrated. However, the response was dependent upon interval between injections. Further research is required to determine optimal dose and interval.

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# Reliability and initial validation of SIESTA-II, A short form of SIESTA (SEAAV Integrated Evaluation Sedation Tool for Anaesthesia) for dogs.

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A standardised tool is essential for consistent canine sedation assessment in research and clinical settings. We evaluated inter- and intra-observer reliability, internal consistency and overall measurement precision of the SIESTA-II, a short form of the SIESTA scale.

Twenty-one Spanish-speaking veterinary anaesthetists assessed eleven parameters from the SIESTA scale, a subjective sedation rating (SUBJECTIVE) and a score using the proposed algorithm (ALGORITHM) on 25 videos viewed twice, 28 days apart. Weighted Cohen's κ and Fleiss' κ quantified inter-observer agreement; intra-observer κ was derived from paired viewings. A cumulative link mixed model estimated the intraclass correlation coefficient (ICC). Generalisability theory partitioned variance components. Cronbach's α and the graded-response IRT model examined internal consistency. A random forest explored variable importance.

Inter-observer agreement, measured by Fleiss's κ, ranged from 0.64 to 0.83, closely mirroring pairwise mean weighted Cohen's $\kappa^2$ values (0.20–0.84). The SUBJECTIVE and ALGORITHM scores yielded Fleiss's κ values of 0.61 and 0.63, and Cohen's k values of 0.76 and 0.78, respectively. Intra-observer agreement (pairwise weighted Cohen's $\kappa^2$) lay between 0.43 and 0.90, with Fleiss's κ for repeated ratings similarly high (0.66 for SUBJECTIVE, 0.66 for ALGORITHM). A cumulative link mixed model partitioned variance into case and evaluator components, yielding an adjusted intraclass correlation coefficient of 0.922, with case-level variance (82.8 %) far exceeding evaluator variance (1.0 %). D-studies showed 30 cases yielded a generalisability coefficient $G\rho_2$ of about 0.66, while four raters met $G\rho_2 \geq 0.95$. Cronbach's α (0.698) assessed internal consistency, and a graded-response IRT model confirmed unidimensionality, ordered thresholds, and acceptable discrimination. Random forest analysis revealed head position, posture change, and movement as the best predictors for subjective sedation ratings.

The SIESTA-II scale shows excellent inter- and intra-observer reliability, acceptable internal consistency, and strong generalisability, supporting its use for standardised canine sedation assessment in research and clinical practice.

Reference

Martinez-Taboada F, Redondo JI, 2020. The SIESTA (SEAAV Integrated evaluation sedation tool for anaesthesia) project: Initial development of a multifactorial sedation assessment tool for dogs. PLoS ONE 15,e0230799. https://doi.org/10.1371/journal.pone.0230799

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# Preliminary study of the use of butorphanol-midazolam or methadone-midazolam to sedate rabbits

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Rabbits often require sedation for procedures that may involve painful interventions.

This preliminary, prospective, randomised, and blinded study aimed to compare the sedative and physiological effects of IM methadone–midazolam versus butorphanol–midazolam in rabbits. Eleven New Zealand White rabbits (3 males, 8 females; median weight 2.08 [1.49–2.37] kg; age 3.5 [3–4] months) were included. Animals received either butorphanol (0.5 mg $kg^{-1}$) or methadone (1 mg $kg^{-1}$) combined with midazolam (1 mg $kg^{-1}$) IM. Baseline HR, SAP, DAP, MAP, and $SpO_2$ and at 10- and 20-minute post-administration, were recorded. A rabbit sedation scale (Raulic et al., 2021) was applied at the same time points. Anaesthesia was induced 30 minutes later with IV alfaxalone, titrated to effect. Data were assessed for normality using the Shapiro–Wilk test. A two-way repeated measures ANOVA evaluated the effects of treatment and time. Mauchly's test assessed sphericity, with Huynh–Feldt correction applied when violated. The Wilcoxon test was used to compare alfaxalone doses. Data are presented as median (P25–P75); significance was set at $p < 0.05$.

No significant differences were observed between groups in HR, $SpO_2$, sedation score, or alfaxalone requirements. The methadone–midazolam group showed higher fR at 10 and 20 minutes ($p = 0.040$), and higher SAP ($p = 0.045$) at 20 minutes. Within-group analysis showed increases from baseline in fR ($p = 0.001$), SAP ($p = 0.008$), DAP ($p = 0.005$), and MAP ($p = 0.005$–$0.026$) at various time points. In conclusion, methadone–midazolam provides sedation comparable to butorphanol–midazolam in rabbits, with similar alfaxalone requirements for anaesthetic induction. However, methadone may be associated with increased blood pressure.

Further studies with larger sample sizes are needed to confirm these findings.

**Reference**

Raulic J, Leung VSY, Doss GA, et al. (2021) Development and testing of a sedation scale use in rabbits (*Oryctolagus cuniculus*). J Am Assoc Lab Anim Sci 60, 549–555.

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4807

# Retrospective evaluation of dexmedetomidine and magnesium sulfate during adrenalectomy for pheochromocytoma in dogs.

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Magnesium sulfate (MgSO4) and dexmedetomidine have been effective as an adjunct for catecholamine blockade and hemodynamic control in humans but have not been described in dogs.

A retrospective study was performed evaluating hemodynamic stability between MGSO4 and dexmedetomidine and MgSO4 (DEXMgSO4) in 25 dogs (15 male, 10 female) undergoing adrenalectomy for pheochromocytoma removal at xxx Veterinary Teaching Hospital between 2019 and 2023. Median (range) age and weight were 10 (6-13) years and 17 (5-50) kg, respectively. Phenoxybenzamine was administered in all dogs daily for 15 days prior to surgery. Following opioid premedication, anesthesia was induced with propofol (n = 11), alfaxalone (n = 10), etomidate (n = 3), or fentanyl (n = 1). Co-induction agents included lidocaine (n = 1) and midazolam (n = 24). Anesthetic maintenance was achieved using isoflurane with fentanyl (n = 15) infusion and/or transversus abdominis plane block (n = 10). Dogs were divided into two groups: MgSO4 (n = 13), DEXMgSO4 (n = 12). Mean arterial pressure (MAP) was collected at 3 time points: before (MAPb), during (MAPd) and after (MAPa) adrenalectomy. Intravenous clevidipine and esmolol were used to treat hypertension and arrhythmia, respectively. Data normality distribution was evaluated using Shapiro-Wilk test. Wilcoxon test was used to compare data between groups (alpha < 0.05).

There was no significant difference in MAPb (p = 0.127), MAPd (p = 0.383) and MAPa (p = 0.127) between groups. Hypertension treatment was performed with clevidipine (MgSO4 n = 5, DEXMgSO4 n = 8) and it was not significantly different (p = 0.393) between groups. Ventricular tachycardia requiring esmolol occurred in two dogs (MgSO4).

Dexmedetomidine did not appear to improve mean arterial pressure oscillations when compared with magnesium sulfate in this small retrospective study. A prospective study is needed to confirm the findings of this study.

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# Prospective monitoring of post-anaesthetic morbidities in horses: Preliminary results from a CEPEF-4 satellite study

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Large-scale prospective studies investigating post-anaesthetic morbidity in horses are scarce. We sought to establish the prevalence and type of complications within 7 days after general anaesthesia. Eight centres prospectively reported morbidity up to one week for each patient undergoing general anaesthesia.

Working definitions were drawn up for 45 individual morbidities within 8 organ system categories. An online form was created, with case ID linking to the corresponding CEPEF4 mortality database entry. Preliminary datasets for 7 centres were reviewed and analyzed using descriptive and chi-square statistics.

Post-anaesthetic complications occurred in 599 of 3,412 cases, giving an overall prevalence of 17.6%. In total, 233 of 688 colic cases incurred morbidity (33.8%), compared to 366 of 2,724 non-colic cases (13.4%; $p < 0.0001$). A total of 905 complications were reported: 451 in colic cases and 454 in non-colic cases. More colic cases incurred two or more complications compared to non-colic cases ($p < 0.0001$). In non-colic cases, gastro-intestinal morbidity was most common (26.7% of all complications), followed by pyrexia (20.5%), surgical site (13.7%), cardiovascular (10.4%), and neuromuscular / musculoskeletal complications (9.9%). In colic cases, the top five consisted of gastro-intestinal (40.6%), surgical site (17.7%), pyrexia (16.0%), cardiovascular (10.2%), and respiratory complications (5.8%). Of all reported morbidities, 32.7% occurred in recovery or the first 24 post-anaesthetic hours. Structured interviews with ambassadors revealed challenges with case follow-up and reporting in some centres. Importantly, 5/7 mentioned a positive impact of study participation on hospital patient safety culture and inter-disciplinary collaboration.

Gastro-intestinal morbidities, pyrexia, and surgical site complications were the most frequent post-anaesthetic morbidities. Horses were more likely to develop complications after general anaesthesia for colic surgery. Prospective monitoring of morbidities requires rigorous definitions, and comprehensive detection and reporting is labour intensive. For CEPEF5, integration of morbidity and mortality reporting via the website would be preferable.

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# A single-cohort retrospective study of general anesthesia related complications in 162 bovines

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Few studies have explored anesthetic complications in bovines. The aim of this study was to describe intraoperative complications and risk factors during anesthesia of bovines at Auburn University from 2011 to 2023.

Anesthetics records of bovines were reviewed and selected based on completeness, anesthetic variables and complications. Binomial multivariate logistic regression was used to assess the relationship between the presence or absence of complications (dependent variables) and potential risk factors (independent variables). Significance was set at $p < 0.05$. Dependent variables were hypotension, hypertension, tachycardia, bradycardia, hypercapnia, and decreased SpO2. Independent variables included, age, breed, sex, body weight, ASA score, surgery type, premedication, induction and maintenance agents, duration of anesthesia, procedure, recovery, monitoring, extubation time and recovery quality. Data are presented as mean ± standard deviation Age and weight were 1.62 ± 2.34 years and 387.0 ± 345.5 Kg with 84.5% of the patients classified as ASA I and II.

No mortalities were recorded, but 88.8% of the patients developed at least one intraoperative complications, with hypotension being the most frequent (63.5%) followed by bradycardia (35.4%) and decreased SpO2 (32.0%). Duration of anesthesia ($p < 0.01$, OR = 1.02) and the inclusion of an alpha-2 agonist ($p < 0.013$, OR = 3.19) during induction increased the risk of developing intraoperative hypotension (R2 = 0.41) and bradycardia (R2 = 0.50). Increased weight was associated with a lower risk of hypercapnia, but this protective effect was only observed in ventilated animals (R2 = 0.42, $p < 0.025$, OR = 0.99). Non-premedicated ($p < 0.026$, OR = 10.7) and non-ventilated ($p < 0.008$, OR = 2.7) patients had a markedly increased risk of a decrease in SpO2 values intraoperatively (R2 = 0.31).

This retrospective study describes a high incidence of intraoperative complications, with hypotension being the most frequent. Several risk and protective factors were identified, which may help improve management of bovines during general anesthesia.

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# Assessment of the pharmacokinetics and selected physiological and behavioral effects of three doses of orally administered tapentadol in horses

**Khursheed Mama**[1], Heather Knych[2], Anabella Lynch[2] Daniel Mckemie[2]

[1]*Colorado State University* , [2]*University of California Davis*, Tapentadol is a chemically synthesized compound with a dual mechanism of action as a Mu receptor agonist and norepinephrine reuptake inhibitor. This dual action offers a potential advantage of efficacy with reduced side effects in horses where opioid dose and duration related gastrointestinal stasis and excitement may be observed.

Six adult, healthy, unfasted, thoroughbred horses received an escalating dose of tapentadol 1, 3, 5 mg $kg^{-1}$ orally in sweet feed with a 2-week washout period between doses. Blood was sampled from the jugular vein at fixed time points for 72 hours post administration (19 samples) for determination of tapentadol concentrations using liquid chromatography tandem mass spectrometry. Non-compartmental pharmacokinetic analysis was performed. Pre- and post-drug related behavior, locomotor activity, heart rate and gastrointestinal sounds were recorded. Nonparametric tests (Friedman and Wilcoxon signed rank) were used to assess pharmacokinetic data reported as median (range). Significance at $P < 0.05$. As shown in people, tapentadol was rapidly absorbed reaching maximum and dose dependent concentrations in less than one hour (Table 1).

At the highest dose, drug concentrations remained in the therapeutic range described for people for approximately 4 hours. There was some early variation in HR (to a peak of 60 bpm) with higher doses, and dose dependent changes in borborygmi during the first 6 hours post administration; no overt signs of colic were observed. Preliminary review of step counts did not reflect clinically relevant changes over the measurement period.

The ability to reach potentially effective plasma concentrations with oral administration and observation of limited side effects is encouraging for further study of tapentadol as an analgesic for horses.

| Dose mg/kg | Cmax (ng $mL^{-1}$) | Tmax (h) |
|---|---|---|
| | | |
| 1 | 5.6 (3.3 - 21.7) | 0.75 (0.5 - 1) |
| 3 | 17.8 (5.4 - 145) | 0.625 (0.16-1) |
| 5 | 158 (20.5 - 626.2) | 0.375 (0.25-0.75) |

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# Sedative and analgesic effects of intramuscular methadone in rabbits undergoing ovariohysterectomy: preliminary results

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Effective pain management in rabbits remains a clinical challenge due to limited species-specific data (Benato et al. 2019). This randomized, controlled, blinded clinical trial aimed to evaluate the sedative and analgesic effects of IM methadone in female rabbits undergoing elective ovariohysterectomy.

Thirteen healthy, mixed-breed rabbits (mean weight: 3.2 ± 1.1 kg; age: 31 ± 13 months) were randomly assigned to receive IM dexmedetomidine (20 µg $kg^{-1}$) and midazolam (1 mg $kg^{-1}$), combined with either NaCl 0.9% (0.02 mL $kg^{-1}$; control), low-dose methadone (1 mg $kg^{-1}$), or high-dose methadone (2 mg $kg^{-1}$) as premedication. Sedation was assessed 10 minutes post-administration (Raulic et al. 2021). Anaesthesia was induced and maintained with isoflurane in oxygen, and all rabbits were mechanically ventilated. Intraoperative nociception was continuously estimated via HR, *f*r, and invasive arterial blood pressure. Capnography was also monitored. Fentanyl (5 µg $kg^{-1}$ IV) was administered as rescue analgesia if any parameter increased >20% from baseline or if ventilatory asynchrony occurred. At the end of surgery, all animals received IV meloxicam (0.3 mg $kg^{-1}$), atipamezole (0.2 mg $kg^{-1}$), flumazenil (0.1 mg $kg^{-1}$), famotidine (1 mg $kg^{-1}$), and metoclopramide (2 mg $kg^{-1}$). Postoperative pain was assessed hourly for 8 hours following extubation (T1–T8) using the Bristol Rabbit Pain Scale (BRPS) and Rabbit Grimace Scale (RbtGS). Buprenorphine was administered as postoperative rescue analgesia based on predefined pain thresholds and clinical criteria. Pain scores were compared between groups and against baseline (T0) using ANOVA and repeated measures ANOVA ($p < 0.05$).

Sedation scores, isoflurane requirements (mean end-tidal concentrations), and rescue analgesia were similar between groups. The BRPS scores differed significantly between treatments ($p = 0.012$) and timepoints ($p = 0.006$), with lower scores in methadone groups at T2 ($p = 0.004$) and in the high-dose group at T4 ($p = 0.018$), compared to control group. RbtGS varied over time ($p < 0.001$), but not between groups (Table 1).

Methadone, particularly at 2 mg $kg^{-1}$, enhanced postoperative analgesia and reduced pain scores, supporting its role in multimodal analgesia protocols for rabbits.

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# Effects of helium/oxygen mixtures on inspiratory resistance to gas flow during volume-controlled ventilation: an “in vitro” simulation for cats

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Helium/oxygen mixtures (heliox) may decrease airway resistance (Raw) when compared to 100% FiO2 (FiO2(100%)) or oxygen/nitrogen mixtures. This study evaluated the effects of heliox, at different concentrations, on inspiratory resistance (Rinsp) using an in vitro model of volume-controlled ventilation in cats.

The ventilator, adjusted to deliver a VT of 40 mL (inspiratory time 1.5 seconds, 50% inspiratory pause, zero end-expiratory pressure), was connected to a test lung (compliance 8 mL cmH2O-1). The Rinsp was recorded as the endotracheal tube internal diameter ETtube(ID) was decreased from 4.5 (ETtube(4.5)) to 3.5 (ETtube(3.5)) and 2.5 mm (ETtube(3.5)) (n = 6 for each ETtube(ID)) with FiO2(100%), 50% FiO2 and 50% helium (Heliox(50%)), and 30% FiO2 and 70% helium (Heliox(70%). The same oxygen/nitrogen mixtures were used as controls. A two-way ANOVA followed by Tukey and Bonferroni tests analyzed data ($p < 0.05$).

Regardless of the heliox concentration, Rinsp significantly increased ($p < 0.0001$) by 9-10 times as the ETtube(ID) was decreased from 4.5 to 2.5 mm ($p < 0.0001$). Use of Heliox(50%) and Heliox(70%) significantly decreased Rinsp in comparison to FiO2(100%) regardless of the ETtube(ID) ($p = 0.003$ to $< 0.0001$). With the ETtube (2.5) Rinsp [cmH2O (L second-1)–1] was significantly decreased from 63.9 ± 2.6 (FiO2(100%)) to 49.7 ± 1.6 (Heliox(50%)) and to 42.9 ± 2.1 (Heliox(70%)) ($p < 0.0001$ for all comparisons). With the ETtube(2.5), oxygen/nitrogen mixtures resulted in smaller decreases in Rinsp compared to Fi=-O2(100%) (FiO2 50%: 8.5% decrease; FiO2 30%: 9.1% decrease) than helium/oxygen mixtures (Heliox(50%): 22.3% decrease; Heliox(70%): 32.9% decrease) ($p < 0.0001$ for all comparisons).

Heliox minimized the increase in resistance to gas flow induced by progressive decreases in ETtube(ID). Its use may be beneficial in cats receiving mechanical ventilation with increased Raw.

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# Anesthetic management and complications of transcatheter edge-to-edge repair for myxomatous mitral valve disease in dogs: 29 cases

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Transcatheter edge-to-edge repair (TEER) is gaining popularity outside academic institutions as a treatment option for mitral valve disease. The aim of this study was to report on the management and complications of anesthesia in dogs undergoing this procedure.

Medical records of dogs diagnosed with myxomatous mitral valve disease undergoing anesthesia for TEER procedures at two institutions were reviewed. Twenty-nine cases were identified (22 males and 7 females). Median (range) age and bodyweight was 10 (3 to 15) years and 6.7 (3.5 to 14.7) kg, respectively. The most represented breed was the Chihuahua (n = 5, 17%). Mitral valve disease was classified as ACVIM Stage B2 (n = 11, 38%), C (n = 17, 59%), or D (n = 1, 3%). Intravenous preanesthetic medication with median dosages (range) included pantoprazole (n = 29, 1 mg kg-1), maropitant (n = 29, 1 mg kg-1), fentanyl (n=23, 3 (2.9-5.5) mg kg-1), methadone (n = 2, 0.2 mg kg-1) and morphine (n = 4, 0.1 mg kg-1). Induction agent combinations included alfaxalone (n = 1), alfaxalone-midazolam (n = 7), alfaxalone-lidocaine (n = 11), propofol-midazolam (n=1), etomidate-midazolam (n = 7), or etomidate-midazolam-lidocaine (n = 2). Anesthesia was maintained with isoflurane and with either fentanyl (n = 11), fentanyl-lidocaine (n = 9), fentanyl-midazolam (n = 3), or another full-mu agonist opioid infusion with lidocaine (n = 6).

Twenty-eight dogs received an intercostal nerve block with ropivacaine at a 1.2 (0.9-2.1) mg kg-1. Anesthetic and surgery times (mean ± sd) were 213 ± 40 minutes and 116 ± 24 minutes, respectively. Cardiac arrhythmias were observed in all dogs. Other significant complications included hemorrhage (n = 6) and respiratory derangements (n = 11). Perioperative death occurred in one dog.

Due to the frequency of complications associated with TEER procedures, anesthetic management requires intense monitoring and preparation to immediately treat complications.

4849

# Interventional pain management in dogs with lumbosacral stenosis: preliminary retrospective long-term clinical outcomes of combined foraminal and epidural injections with or without pulsed radiofrequency

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Lumbosacral stenosis is a recognised cause of pain in dogs, often involving disc herniation and foraminal narrowing with associated radiculopathy (Medina-Serra et al. 2025). In humans, transforaminal injections demonstrate superior outcomes to interlaminar approaches (Kwak et al. 2023) and are frequently combined with pulsed radiofrequency (PRF) at the dorsal root ganglion (DRG) to enhance pain relief (Park et al. 2024). However, their clinical utility in dogs with naturally occurring lumbosacral pain remains unreported.

This retrospective cohort study evaluated long-term outcomes (capped at 24 months) following a single procedure involving ultrasound and fluoroscopy-guided foraminal and epidural corticosteroid and local anaesthetic injections, with (PRF; 9 dogs) or without PRF (No-PRF; 9 dogs) at the L7 DRG, in dogs with chronic lumbosacral pain. Outcome measures included ordinal clinical pain scores (single assessor) and Canine Brief Pain Inventory (CBPI) scores. Clinically relevant improvement was defined as a two-grade reduction in clinical pain score and a CBPI decrease of ≥1 point in pain severity and ≥2 points in pain interference. Data were analysed using Fisher's Exact Test, Wilcoxon signed-rank tests, Mann–Whitney U tests, and generalised linear mixed models in R.

Baseline outcomes did not differ significantly between groups. Pain severity and quality of life (QOL) improved significantly over time within both groups ($p < 0.05$). Dogs receiving PRF had significantly greater QOL improvement ($p = 0.0247$). Clinically relevant improvement was achieved in 9/9 of dogs in the PRF group and 5/9 in the No-PRF group. The median duration of clinically relevant improvement was longer in the PRF group [16.4 (2.2-24) months] than in the No-PRF group [8.9 (0 to 24) months], although this difference was not statistically significant.

These preliminary findings suggest that image-guided targeted injections, with or without adjunctive PRF, may provide long-term pain alleviation in dogs with lumbosacral stenosis.

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4851

# Clinical predictors of recovery quality in equine anesthesia: A retrospective review of 240 cases

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Recovery from general anesthesia in equine patients carries a high risk of morbidity and mortality. Adverse recovery outcomes, including fractures, myopathies, and neuropathies, can compromise otherwise successful surgical procedures. The objective of this retrospective study was to identify peri-anesthetic factors associated with recovery quality in horses undergoing general anesthesia.

Medical records of 240 equine patients anesthetized at the University of Tennessee Equine Hospital were analyzed. Variables including age, weight, ASA physical status, pre-anesthetic behavior scores, anesthesia duration, opioid administration, and infusion of anesthetic/analgesics were evaluated. Recovery outcomes were assessed using a set of perianesthetic composite scores. Mixed model analysis was used, with individual animals as the random effect ($p < 0.05$). Data are presented as mean ± SD.

The mean age and weight were 9.0 ± 7.0 years and 428 ± 159 kg, respectively, with a mean anesthesia duration of 100 ± 61 minutes. The majority of cases were ASA I or II (39.4% and 36.4%), and 14% were classified as emergencies. Partial intravenous anesthesia (PIVA), incorporating continuous rate infusions (CRIs), was implemented in 49.4% of cases. Increased age, longer anesthesia time, higher ASA status, and elevated pre-anesthetic behavior scores were significantly associated with poorer recovery outcomes. Use of CRIs of ketamine combined with xylazine or lidocaine decreased recovery scores compared to inhalant-only protocols. Statistical linear models were developed to predict recovery quality based on individual patient characteristics.

Recovery quality is influenced by both patient- and protocol-specific factors. While PIVA combinations offer many benefits, use of ketamine with xylazine or lidocaine infusion in this study, was associated with a negative impact on the quality of recovery. These findings provide some key information to predict anesthetic risk factors for each individual animal and therefore the opportunity for developing individualized anesthetic protocols to enhance anesthetic safety in equine patients.

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4852

# Ultrasound-guided motor-sparing block of the distal tibia and peroneal nerves in dogs: anatomical study and preliminary clinical results

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A combined proximal sciatic and femoral nerve block is a recognised alternative to neuraxial anaesthesia in dogs undergoing pelvic limb surgery. However, these blocks are associated with delayed ambulation due to motor impairment (Campoy et al. 2012; Boscan & Wennogle 2016). This study aimed to describe the anatomy of the distal tibial and peroneal nerves in dogs and develop an ultrasound-guided block for distal pelvic limb surgery, sparing proximal tarsal muscular branches, intended to provide analgesia while preserving early motor function.

In the initial phase, approved by the Committee of Biosecurity in Experimentation (CBE) at the University of Murcia, two pelvic limbs from a dog cadaver were dissected to identify the course and sonographic appearance of the distal tibial and peroneal nerves at the distal third of the tibia. In a second cadaver, ultrasound-guided dye injections were performed in two pelvic limbs, followed by dissection to confirm nerve staining at the targeted sites.

For preliminary clinical evaluation, the technique was retrospectively assessed in four dogs undergoing distal pelvic limb surgery. Two dogs received ropivacaine 0.75 % and two received bupivacaine 0.5 % (0.2 mL $Kg^{-1}$). Block efficacy was defined by the absence of intraoperative rescue analgesia, determined by heart rate and mean arterial pressure stability (measured five minutes before incision), and postoperative pain scores using the short-form Glasgow Composite Measure Pain Scale. Analgesia was effective in all cases, with a median pain score of 1/20 (range 0-3) until discharge. Early ambulation, defined as weight-bearing on all limbs, was observed in all patients at the first postoperative assessment (median 155 minutes post-block, range 90-220), supporting the motor-sparing effect.

These preliminary findings indicate that this ultrasound-guided distal nerve block may provide effective analgesia while preserving motor function in dogs undergoing distal pelvic limb surgery. Further studies are warranted to confirm these results.

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4853

# Efficacy, pharmacokinetics and safety of liposomal synthetic cannabidiol injected subcutaneously in dogs: A randomized, blinded, placebo-controlled, crossover clinical trial

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Study objectives were to determine the pharmacokinetics and effects of liposomal-synthetic-cannabidiol (L-sCBD) injection compared with placebo in dogs with radiographically confirmed naturally-occurring osteoarthritis.

Eight dogs (4 males, 4 females; 8.5 [4.5-12.5] years-old; 34.9 [22.7-42.7] kg) were injected SC twice with a 4-week interval; once with 7 mg kg-1 L-sCBD (50 mg mL-1) and once with empty liposomes (placebo; equivalent volume) in a randomized, blinded, crossover design. Each dog routine analgesics (e.g., NSAIDs) were continued. Blood was sampled for CBD and metabolites concentrations (baseline, 6-hours, 3-days, and weekly for 4-weeks), and for complete blood count and serum chemistry (baseline, 3-days, 1- and 4-weeks). Efficacy was assessed via activity monitoring collar and scorings by two veterinary specialists (both assessed all dogs) and by owners. Vital signs and local response were monitored. Aligned rank transform ANOVA and permutation tests were used for data analysis ($p$-value < 0.05).

Plasma concentrations of CBD were detected up to 4-weeks; median peak plasma concentration (Cmax) was 58.2 [range 35.1-141.0] ng mL-1, median time to Cmax was 3 [3-7] days and median half-life 6.1 [4.6-9.5] days. The metabolites 6-hydroxy-CBD, 7-hydroxy-CBD and 7-carboxy-CBD were detected at low concentrations. Pain and lameness scores and behavior were significantly improved after L-sCBD treatment versus placebo. At 3-days after L-sCBD treatment, neutrophils and alkaline-phosphatase increased significantly, while hematocrit and albumin decreased (all within reference range, except neutrophils in 2/8 dogs). Adverse effects included 2-days fever and a minor-moderate local swelling, which resolved spontaneously.

Subcutaneous L-sCBD provided long-term CBD plasma concentrations, improved analgesia and was tolerated by dogs. A larger clinical cohort is required to further assess L-sCBD benefits and safety.

4856

# Treatment of abnormal pain or unpleasant sensation with constant rate infusion of ketamine in cats – a case study

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Abnormal pain or unpleasant sensations can lead to symptoms such as self-mutilation and significantly impair the quality of life (QoL) for both the patient and caregiver. This study aimed to investigate the effects of the intravenous constant rate infusion (CRI) of ketamine on symptoms of abnormal pain or unpleasant sensation in cats.

Three cats diagnosed with dysesthesia based on history, neurological and orthopedic examinations, bloodwork, and urinalysis were enrolled. All cats exhibited distress focused on their tails and repeated self-mutilation. On the treatment day, a ketamine CRI was administered at 2 mcg kg-1 min-1 following a loading dose of 0.5 mg kg-1 IV. The CRI was maintained for 12 to 24 hours. Follow-up visits were scheduled at 2 weeks and at 1, 3, 6, and 12 months post-treatment. Owners completed a validated health-related QoL (HRQoL) questionnaire for cats before treatment and at 1, 2, 3, 4, and 6 weeks, as well as 2, 3, 4, 5, 6, 9, and 12 months after treatment. The HRQoL score (0-100) was subsequently calculated. If symptoms worsened within 4 weeks post-treatment, a second infusion was administered at 5 mcg kg-1 min-1 with the same loading dose.

Dysesthesia symptoms in two cats (Cat-1 and Cat-2) markedly improved after a ketamine CRI. Cat-1's symptoms resolved completely for nearly a year, with its HRQoL score improving within 2 weeks (from 75.2 to 92.7). Cat-2 required a second infusion. Its initial HRQoL score was already high and remained consistently high after treatments (97-100). Cat-3 showed mild improvement but was later excluded due to the owner's decision.

Ketamine CRI appears to be effective in alleviating dysesthesia symptoms in cats. Further research is needed to determine the optimal rate and duration of infusion, as well as the specific types of sensations ketamine CRI can effectively treat.

4858

# Evaluation of risk factors leading to poor anesthetic recovery after ocular surgery in academic small animal practice

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This study examined possible risk factors associated with poor quality of recovery (QoR) in dogs and cats undergoing general anesthesia for ocular surgery in an academic teaching hospital.

In this retrospective cohort study, data from 305 records of dogs and cats that underwent general anesthesia for ocular surgery between September 2022 and May 2024 were examined for associations between QoR and other variables, including age, weight, sex, anesthetic risk, total anesthesia time, type of ocular surgical procedure, premedication, induction, and maintenance agents, intra-operative analgesics, pre-recovery sedation, and post-operative pain score (Glasgow Composite Measure Pain Scale – short form; maximal score 20) and temperature. Requirements for sedation and rescue analgesia during the recovery period were also evaluated. QoR was determined using a modified recovery scale and categorized as good or poor. Multivariate analysis of variance with adjustments for multiple comparisons was performed. Results are presented as mean ± standard deviation with statistical significance at $p < 0.05$.

288 anesthetic records met inclusion criteria (249 dogs, 39 cats). 88/288 [30.6%; 77 dogs (30.9%), 11 cats (28.2%)] records indicated a poor QoR. Young cats were more likely to have a poor QoR ($p = 0.005$). No other variables were identified as risk factors for poor QoR. Most (88.6%; dogs 88.3%, cats 90.9%) patients categorized as poor QoR received sedation during the recovery period.

Poor anesthetic recovery in dogs and cats undergoing general anesthesia for ocular surgery is common. While young cats were more likely to have a poor QoR, no other specific risk factors were found in the population examined.

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4863

# Cardiovascular effects of intramuscular medetomidine-vatinoxan with or without methadone in dogs anesthetised with sevoflurane

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Alpha2-agonists are often used as preanesthetics in combination with opioids. The objective of this study was to determine whether methadone would influence the cardiovascular effects of medetomidine-vatinoxan during sevoflurane anesthesia.

In this cross-over experimental study, six healthy Beagles pre-instrumented with digital radiotelemetry transmitter and aortic flow probes received medetomidine 0.25 mg m-2 and vatinoxan 5 mg m-2 (Zenalpha), with or without methadone 0.2 mg kg-1 (Zenalpha-methadone) intramuscularly. Anesthesia was induced with propofol approximately 20 minutes later (T0) and maintained with sevoflurane in total of 60 minutes (T60). Heart rate (HR), direct mean arterial pressure (IBP), cardiac (CI) and stroke volume indices (SVI) were recorded every 5 minutes. Each of the variables were analysed via a mixed linear model repeated measures analysis with $p \leq 0.05$ considered significant.

There were no statistically significant differences between the treatments in HR, IBP or CI during anesthesia. With Zenalpha-methadone SVI was significantly higher from T30 to T60 in comparison to Zenalpha.

Combining methadone to medetomidine-vatinoxan did not cause clinically relevant cardiovascular changes during sevoflurane anesthesia in healthy dogs.

Table 1: Cardiovascular variables (mean ± SD) during sevoflurane anesthesia in dogs premedicated with medetomidine-vatinoxan (Zenalpha) with or without methadone

| Treatment | Time (minutes) | HR (beats minute$^{-1}$) | IBP (mmHg) | CI (L minute$^{-1}$ m$^{-2}$) | SVI (mL m$^{-2}$) |
|---|---|---|---|---|---|
| Zenalpha | 10 | 93 ± 14 | 92 ± 7 | 2.7 ± 0.3 | 30 ± 4 |
| Zenalpha-methadone | | 90 ± 10 | 84 ± 15 | 2.6 ± 0.8 | 29 ± 7 |
| Zenalpha | 30 | 104 ± 7 | 67 ± 5 | 2.2 ± 0.3 | 22 ± 3 |
| Zenalpha-methadone | | 100 ± 19 | 64 ± 3 | 2.5 ± 0.5 | 25 ± 5* |
| Zenalpha | 50 | 99 ± 10 | 70 ± 6 | 1.9 ± 0.2 | 20 ± 4 |
| Zenalpha-methadone | | 93 ± 11 | 67 ± 5 | 2.2 ± 0.4 | 24 ± 5* |

* Significant difference between treatments, $p \leq 0.05$

4957

# Pharmacokinetics of a high oral dose of a compounded tramadol hydrochloride suspension in domestic rabbits (*Oryctolagus cuniculus*)

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Tramadol is a weak opioid mu-agonist, a serotonin-reuptake inhibitor and N-methyl-D-aspartate receptor antagonist. The analgesic effect of tramadol in rabbits has been documented through a model of reduction of the MAC of isoflurane (Egger et al. 2009). Despite the low bioavailability of an oral dose of 11 mg kg-1 (Souza et al. 2008), empirical use is common in domestic rabbits.

The present pilot study was conducted in two rabbits to evaluate the sedative effects of an oral dose of 30 mg kg-1 based on a validated sedation scale (Raulic et al. 2021).The same oral dose was then administered to six healthy male rabbits and plasma concentrations of tramadol and its metabolites, O-desmethyltramadol (M1) and N-desmethyltramadol (M2), were determined by high performance liquid chromatography at 10, 20, 30, 45, 60, 90 minutes and 2, 3, 4, 6, and 10 hours. Pharmacokinetic parameters were calculated using a commercial software (PK Solver 2.0). Duration of analgesic effect was based on the minimal efficient plasma concentration determined in a previous pharmacodynamic study in rabbits using a model of isoflurane MAC reduction (Egger et al. 2009).

Average time to tramadol maximum plasmatic concentration (Cmax) was 40 minutes (91 ng ml-1 ± 38), terminal half-life (T1/2) was 4.0 hours ± 2.4 and mean area under the curve (AUC) from the first dose to infinity were 192 ng h ml-1. The M1 metabolite reached concentrations compatible with analgesic effect after 10 minutes and up to 3 hours after administration in some individuals, while tramadol did not reach analgesic concentrations based on the previous pharmacodynamic study (Egger et al. 2009). Mild sedation was detected in four rabbits at the 20 minutes to 6 hours timepoints. No adverse effects were noted in any of the rabbits.

Given the short duration of action, clinical use may be limited.

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# Pharmacokinetics of a single dose of oral tramadol in brook trout (*Salvelinus fontinalis*)

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Fish antinociception has gained interest in research but effective analgesia has only been documented for injectable drugs, such as morphine (Romano et al. 2024) or robenacoxib (Raulic et al. 2021). The aim of this study was to determine pharmacokinetic parameters after oral administration of a single dose of tramadol HCl and to evaluate clinically detectable adverse effects in fish.

Six healthy adult book trout *(Salvelinus fontinalis)* kept in water at 11°C, 5 males and 1 female (weight range: 1025-1333 grams), were gavage fed with 5 mg kg-1 of a tramadol compounded suspension (Summit Pharmacy, Aurora, ON, Canada) (24-Rech-2294). Tramadol was administered via a 10-Fr red rubber tube in the stomach along with yellow-colored solution. The cranial part of the body was maintained elevated for 30 seconds to prevent regurgitation. Blood samples of 0.3 mL were obtained by venipuncture from the ventral coccygeal vein at 1, 2, 4, 6, 24, 32 and 46 hours after drug administration. Sedation was evaluated at each timepoint using a semi-quantitative score. Plasma concentration of tramadol and its two main metabolites M1 (O-desmethyltramadol) and M2 (N-desmethyltramadol) were measured by high-performance-liquid-chromatography.

High interindividual variability was noted. Tramadol mean elimination half-life was 19 hours. Time to peak drug concentration (Tmax) of tramadol was reached in around 24h and Tmax of M1 in around 2 hours. Only M1 reached concentrations compatible with analgesia in mammals, above 32 ng mL-1 (Egger et al. 2009) in 5 out of 6 individuals. Sedation was noted in all fish at 24 hours. No adverse effects were detected and the fish were alive 6 months after the study.

Further studies should evaluate the pharmacodynamics of tramadol in fish. If analgesic effect is demonstrated, tramadol could be administered through medicated diets in ornamental fish.

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# Effects of temperature on sedation induced by midazolam in bearded dragons (*Pogona vitticeps*)

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Midazolam is commonly used in reptiles (Arnett-Chinn et al., 2016) and maintaining an optimal body temperature is recommended during sedation in these species (Kischinovsky et al., 2013). The study aimed to evaluate the effects of different temperatures on sedation in bearded dragons.

In a randomized, crossover study, eight laboratory bearded dragons (13–14 months old) were given midazolam (1 mg $kg^{-1}$) subcutaneously cranial to a forelimb under normothermia (28–32 °C, MN) and hypothermia (18–21 °C, MH), with a washout period of 14–16 days. The experimental room was maintained at 19 ± 1°C. For MH, experiments began only when animals reached 18–21 °C. A heat lamp prevented temperatures from dropping below 18 °C for MH and maintained optimal conditions for MN. Animals were video-recorded at baseline (T0) and from 10 to 180 minutes postinjection (T10–T180). Recordings were scored by the same blinded observer (MR) using a validated sedation scale (0–12) (Pinho et al., 2024). For MH, a heat pad was provided after the T90 to simulate anesthesia recovery active warming. Sedation scores were compared within (Friedman and Dunn's) and between treatments (Wilcoxon paired test). Data are presented as median (range). *P* value was significant when < 0.05. Incidence of loss of righting reflex (LORR) was analyzed descriptively.

Peak of sedation occurred at T120 for MN [5 (2–6)] and at T60 for MH [6 (2–8)]. Sedation scores were significantly higher than T0 at T30–T180 for MN ($p < 0.047$), and from T20–T120 ($p < 0.033$) and at T180 ($p = 0.010$) for MH. No significant differences were found between treatments at any time point ($p > 0.08$). LORR was observed only in MH (n = 6).

Subcutaneous midazolam produced similar levels of sedation in bearded dragons at both temperatures. Sedation peaked earlier and LORR occurred only in hypothermia.

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# Total intravenous anaesthesia with remimazolam–ketamine–medetomidine in Thoroughbred horses

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Remimazolam is a new ultra-short-acting benzodiazepine that may replace midazolam in humans because of rapid recovery and safety. We compared total intravenous anaesthesia (TIVA) using remimazolam or midazolam in Thoroughbred horses.

Seven Thoroughbreds (4-6 years, 444-538 kg of body weight) were anesthetized with remimazolam–ketamine–medetomidine (RKM) or midazolam–ketamine–medetomidine (MKM) (blinded randomized cross-over design). Five minutes after premedication with IV medetomidine (5.0 μg $kg^{-1}$), anaesthesia was induced with IV remimazolam (0.05 mg $kg^{-1}$) or IV midazolam (0.05 mg $kg^{-1}$) followed by IV ketamine (2.0 mg $kg^{-1}$). Anaesthesia was maintained for 60 minutes with constant-rate remimazolam (0.5 mg $kg^{-1}$ $hour^{-1}$) or midazolam (0.1 mg $kg^{-1}$ $hour^{-1}$) plus ketamine (3.0 mg $kg^{-1}$ $hour^{-1}$) and medetomidine (5.0 μg $kg^{-1}$ $hour^{-1}$). HR, fr, arterial blood pressure and arterial blood gases were recorded every 5 minutes. Induction and recovery time were recorded. Induction and recovery qualities were scored on a scale of 1 (poor) to 5 (excellent). Statistical methods were the paired t-test for time and Wilcoxon signed-rank sum test for score.

There were no significant differences in induction time and score between RKM and MKM. No apnea was observed, and there were no significant differences in cardiopulmonary values between the two methods. Three horses showed awakening signs (nystagmus, slight limb movements, temporary increase in blood pressure) with both methods, but these signs disappeared soon and no additional anesthetics were required for maintenance. Recovery time (mean ± SD) with RKM (20 ± 10 minutes) was significantly shorter than with MKM (33 ± 11 minutes), and recovery score (median, range) with RKM (4, 3–5) was significantly higher than with MKM (2, 2–4).

TIVA with RKM produced faster and better-quality recovery than MKM in Thoroughbreds.

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# Ultrasound-guided transversus abdominis plane block in pigs undergoing laparoscopic ovariectomy: a preliminary clinical study

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The transversus abdominis plane (TAP) block desensitises abdominal wall and peritoneum. Porcine cadaver studies have described the technique, however clinical trials in pigs are lacking.

This study evaluated the isoflurane-sparing effect and the intra- and postoperative analgesic efficacy of an ultrasound-guided TAP block in pigs undergoing elective laparoscopic ovariectomy. Pigs were randomly allocated to TAP or control groups. Premedication consisted of azaperone, xylazine, butorphanol and ketamine administered IM. Anaesthesia was induced with ketamine ± thiopental IV. The block consisted of a three point per hemiabdomen technique, using lidocaine 1%, 0.1 mL kg-1 point (Michielsen et al. 2021). No sham injection was performed in the control group. Baseline HR and MAP were recorded prior to surgery at 1.0% end-tidal isoflurane (FE_Iso) and at specified time points. A blinded investigator modified the anaesthetic requirements if HR and MAP exceeded 20% from baseline. At the end of anaesthesia, meloxicam was administered IV. Postoperative pain was assessed using the UNESP-Botucatu pig composite acute pain scale. Pigs scoring ≥ 6 received oral paracetamol as rescue analgesia. Data were analysed for differences between and within groups using a linear mixed model, $p < 0.05$.

A total of 29 pigs were recruited, 12 pigs in the TAP group and 14 in the control group; three pigs were excluded. Mean ± standard deviation FE_Iso area-under-the-curve for the duration of anaesthesia were 7.12 ± 0.89 and 7.19 ± 1.04% in the TAP and control groups respectively. There were no differences in HR and MAP between groups. Median pain scores (interquartile range) were 1 (1–4) in the TAP group and 1 (0–2) in controls. There were no significant differences in intraoperative or postoperative rescue analgesia requirements between groups.

Ultrasound-guided TAP block is a feasible technique in pigs. Pigs appeared comfortable throughout the perioperative period, regardless of group allocation.

**Reference**

Michielsen A, Rodrigo-Mocholi D, Cornillie P et al. (2021) Description of different ultrasound guided transversus abdominis plane block in pig cadavers - A pilot study. Vet Anaesth Analg, 48, 470-477.

4968

# Comparison of two volumes of bupivacaine-dye solution on ultrasound-guided sciatic and femoral injections in chickens

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Ultrasound-guided local anesthesia of the sciatic and femoral nerves can be used for surgeries involving structures distal to the mid-femur. The aim of this study was to evaluate two injection volumes of bupivacaine-dye solution on nerve staining.

Eight female chicken cadavers weighting 1.7 ± 0.5 kg were used. The ultrasound transducer was positioned on the lateral aspect of the thigh. Sciatic perineural injections were performed between the iliofibularis and the lateral aspect of the pubo-ischio-femoralis muscle. Femoral perineural injections were performed between the medial aspect of the pubo-ischio-femoralis muscle and the skin. The chickens' legs were randomly assigned to two groups based on the volume of bupivacaine-dye solution (Davidson Marking System; Bradley Products Inc.) diluted at a ratio of 0.1:10. The injectate was administered with the low volume group (LV) receiving 0.2 mL and the high volume group (HV) receiving 0.8 mL. Gross dissections were conducted to assess the distribution of nerve staining. Complete nerve staining was considered when extension of the dye on the nerve was > 1 cm. Coelomic cavity was examined for dye solution. Paired t-test was used to compare groups.

All sciatic nerves for both groups had complete nerve staining. Mean ± SD for LV and HV stained was 2.3 ± 0.7 and 4.7 ± 1.0 cm, respectively ($p = 0.0003$). Two femoral nerves of each group had incomplete nerve staining. Mean ± SD for LV and HV stained was 1.3 ± 0.7 and 2.1 ± 1.4 cm, respectively ($p = 0.0855$). Dye was detected in the coelomic musculature in one chicken and coelomic cavity in another chicken after femoral nerve injections.

Both LV and HV injections consistently stained the sciatic nerve. However, femoral nerve injections demonstrated inconsistent staining regardless of the injection volume used. Improvements to the technique for the femoral nerve approach are necessary.

4972

# Evaluation of femoral nerve block in a multimodal approach during knee arthrotomy in rabbits

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Retrospective study of anesthetic and follow-up records of 32 adult New Zealand rabbits from a biomedical research project approved by the ethics committee (CEA-OH-12188/2). The aim was to assess the efficacy of inguinal femoral nerve block (FNB) as part of a multimodal approach.

The anesthetic protocol included medetomidine, ketamine, midazolam, methadone and meloxicam subcutaneously, intravenous propofol, tracheal intubation, and maintenance with sevoflurane under mechanical ventilation. Spirometry, capnography, SpO2, temperature, and invasive blood pressure were monitored. A fentanyl patch was placed at the end. Two procedures were performed: creation of an osteochondral lesion in the medial condyle (SX1) or bioimplant placement (SX2) 14 days after SX1. The blocking technique with ropivacaine (ROPI) 0.2% or 0.4%, the intraoperative nociceptive response (LIR [low]-: 10 to <5%; MIR [moderate]:>% increase in HR and MAP), the need for intraoperative (IAR) and postoperative analgesic rescue, and voluntary food intake at 24-36 h were analyzed. Fisher's exact test compared data within ROPI and SX groups.

Fifty-seven procedures were performed (32 SX1 and 25 SX2), with FNB ultrasound-guided (US) and nerve-stimulated (NS) in all cases; in 2 cases, no response was obtained to NS. ROPI 0.2% was used in 41 cases and 0.4% in 16 cases, with volumes of 0.1-0.2 ml $kg^{-1}$ based on observed distribution on US. No significant differences were found within the ROPI or SX groups. Seven LIR events were recorded in 6 procedures (one with no NS response during the block). One MIR event was observed. Four IAR were administered in 3 cases. In the 4-hours postoperative period, 7% of cases required postoperative analgesic rescue. Voluntary food intake was 88% at 24 hours, reaching 100% at 36 hours.

The multimodal approach, including FNB with either concentration of ropivacaine, appears valuable and feasible for medial knee arthrotomy and medial condyle injury in rabbits.

4974

# Effect of bupivacaine 0.25% and 0.5% on the nociceptive, motor and proprioceptive response in an ultrasound-guided sciatic nerve model in rats

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Ultrasound-guided sciatic nerve injection has been described in rat cadavers; however, the pharmacological properties of local anesthetics concentration remain underexplored and poorly understood. The objective of this study was to evaluate nociceptive, motor and proprioceptive responses following ultrasound-guided perineural sciatic injections of different concentrations of bupivacaine.

In a randomized, blinded, crossover study, eight Wistar rats underwent isoflurane anesthesia and received ultrasound-guided sciatic nerve injections of 0.1 mL of 0.25% (B25) or 0.5% bupivacaine (B50), with one-week between treatments. Mechanical sensitivity [Electronic Von Frey, (grams +/-)], motor function [tactile placing; gait response (1–3 score)] and proprioceptive functions [grip test (+/-); paw positioning: (clubbed/normal)] were evaluated at baseline (time 0), 10, 20, 30, 40, 60, 90, 120, 180, 240, 300 and 360 minutes post isoflurane recovery. Data were analyzed using mixed models with significance set at $p < 0.05$.

Sciatic nerve blockade was observed within 20 minutes post isoflurane recovery with treatment, time and interaction on nociceptive function being significant from 20 to 240 minutes ($p < 0.05$). Group B25 sensory function peaked at 111.2 grams [95% CI: 100.8–121.5 (-)] at 60 minutes and returned to baseline 55.5 grams [95% CI: 45.2-65.9 (+)] by 240 minutes. Motor and proprioceptive functions were reduced at 20 minutes [median score: 1 (IQR: 1)] and returned to baseline by 240 minutes. Group B50, sensory function peaked at 133.7 grams [95% CI: 123.3–144.1 (-)] at 90 minutes and returned to baseline 52.0 grams [95% CI: 41.6-62.4 (+)] in 300 minutes. Motor and proprioceptive functions were reduced at 10 minutes [1 (IQR: 0.25)] and returned to baseline by 300 minutes.

In conclusion, B25 and B50 achieved complete clinical sciatic nerve blockade in all rats. Duration and efficacy of bupivacaine on nociception, motor and proprioceptive functions appeared to be concentration dependent.

4979

# Efficiency of isoflurane capture from anaesthetised experimental sheep

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The exact number of general anaesthetics performed on research animals in the United Kingdom is unknown but likely exceeds a million per annum (Home Office, 2014). Isoflurane is the most used volatile agent (Cicero et al. 2018) and a greenhouse gas contributing to climate change (Tennison et al. 2021). We evaluated the efficiency of a volatile agent capture device (VET-dock and VET-can, SageTech Veterinary, UK) in anaesthetised experimental sheep.

Sixteen sheep were recruited to fill a single VET-can to capacity. The filled device was returned to the manufacturer and contents extracted from the absorbent. Capture efficiency was determined by comparing the mass of isoflurane delivered with that desorbed. In vivo mass transfer (MT %) was calculated by weighing the VET-can and vaporiser before and after each anaesthetic. Spearman's correlation interrogated associations between MT and patient and anaesthetic variables.

In total, 537 g of liquid was extracted from the VET-can. This represented a 107% fill rate. The overall water captured was 45 g (8%). The weight of isoflurane extracted was 492 g. The weight of change due to isoflurane use from all vaporisers totalled 672.1 g. This resulted in an isoflurane capture efficiency of 56%. Univariate exploratory analysis was performed for 16 anaesthetics. The mean MT was 67% ± 0.15 (n = 16), increasing to 75% ± 0.09 (n = 10) when isoflurane was captured in the prep-room and theatre compared with 46% ± 0.04 (n = 4) where only theatre capture took place. There was a positive correlation between MT capture time as a percentage of total anaesthesia time ($r_s = 0.71$, $p = 0.003$). Rapid recovery and extubation precluded continued capture of isoflurane at the end of the procedure.

Carbon savings of 3.08 $kgCO_2e$ 20 $minutes^{-1}$ of anaesthetic time were achieved. Future studies evaluating wash out kinetics and capture during recovery are indicated.

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4981

# Lumbosacral foraminal injections in dogs: assessing an ultrasound- and fluoroscopy-guided technique in a cadaveric model

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Lumbosacral radiculopathy is the strongest predictor of lumbosacral pain in dogs (Medina-Serra et al. 2025). In human medicine, transforaminal epidural injections allow targeted perineural corticosteroid delivery and improve outcomes in patients with lumbar disc herniation and radicular pain (Kwak et al. 2023). This cadaveric study, approved by the Ethics Committee of Animal Experimentation (814/2022) and the Committee of Biosecurity in Experimentation (508 MEDINA) at the University of Murcia, evaluated injectate distribution using a novel ultrasound- and fluoroscopy-guided technique for lumbosacral foraminal injections in dogs.

Ten injections were performed bilaterally in five thawed adult canine cadavers using 0.1 mL $kg^{-1}$ of a Davidson-tissue-dye and iopromide solution. Needle placement at the cranial aspect of the L7 foramen was guided by ultrasound and confirmed fluoroscopically. Injectate distribution was assessed by fluoroscopy, computed tomography (CT), and anatomical cryosections.

Paravertebral contrast distribution at the foraminal region was observed in all injections (10/10). Epidural spread medial to the intervertebral foramen occurred in 8/10 injections. Anatomical dissections confirmed perineural epidural staining of the L7 spinal nerve in 9/10 injections. Subarachnoid spread was observed in 5/10 injections fluoroscopically and 6/10 by CT, most frequently in cadavers with foraminal stenosis. Intravascular uptake was detected in 1/10 injections by fluoroscopy and 2/10 on CT.

This technique consistently enabled accurate needle placement near the target nerve and achieved perineural and transforaminal epidural spread with minimal vascular uptake. The relatively frequent occurrence of subarachnoid migration reflects the injectate distribution pattern seen in this cadaveric model after initial needle placement. In clinical practice, this corresponds to the preliminary contrast study, allowing real-time assessment and cannula repositioning prior to therapeutic injection. These results support the potential clinical utility of this approach for targeted drug delivery in dogs with lumbosacral radiculopathy. Further research is required to elucidate its safety and efficacy in live animals.

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5010

# Dexmedetomidine versus clonidine as an adjuvant to lidocaine spinal anesthesia in ovine experimental model

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Sheep are routinely used as orthopedic models for their anatomical and physiological similarities to human joints. Spinal anesthesia is a technique that provides adequate analgesia for these procedures (Edmondson 2016). Clonidine is a widely used adjuvant in human spinal anesthesia; dexmedetomidine is a new and more selective alpha-2 agonist than clonidine (Sarma et al. 2015). This study compared the duration and analgesic effect of these two drugs as an adjuvant in spinal anesthesia.

The study involved 39 sheep undergoing experimental pelvic limb cartilage damage surgery. Animals were sedated with diazepam (0.4 mg $kg^{-1}$) and buprenorphine (10 µg $kg^{-1}$) intravenously. Propofol was given as needed (0.5 mg $kg^{-1}$) and oxygen support was continuous. Animals were placed with the treated limb in dependent position for the lumbosacral spinal block. Sheep were divided into three groups of 13 animals, receiving lidocaine 2% (Lgroup), lidocaine 2%+clonidine 2 µg $Kg^{-1}$ (CLgroup) or lidocaine 2%+dexmedetomidine 1 µg $mL^{-1}$ (LDgroup) for spinal block at a dose of 1 mL every 10 kg. After surgery, the times (minute) of recovery of sensibility (RoS) and standing (ToS) from the spinal block were recorded. The degree of ataxia (ATA) was also measured every 10 minutes using a numerical scale (1=absent, 2=mild, 3=severe).

Results are shown in the Table.

Dexmedetomidine is more effective than clonidine in prolonging lidocaine spinal anesthesia. Its effects include both motor and sensory aspects, representing an important refinement of the technique.

| | Lgroup | CLgroup | LDgroup | *p* LvsCL | *p* LvsLD | *p* CLvsLD |
|---|---|---|---|---|---|---|
| RoS (minute) | 146 ± 21.8 | 207 ± 27.1 | 198 ± 60.4 | <.001 | <.008 | |
| ToS (minute) | 127 ± 25.2 | 220 ± 35.7 | 316 ± 80.3 | <.001 | <.001 | <.001 |
| ATA20 (score) | 2 (2-1) | 3 (3-2) | 2 (2-2) | <.001 | | 0.002 |
| ATA30 (score) | 1 (2-1) | 2 (3-2) | 2 (2-2) | <.001 | 0.004 | |
| ATA40 (score) | 1 (1-1) | 1 (2-1) | 2 (2-2) | | <.001 | <.001 |

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5018

# Epidural catheter tip location and its potential adverse events in relation to cranial advancement in dog cadavers

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Epidural catheter tip complications in humans and animals are rare but likely linked to insertion length and catheter type (Brichant et al. 2006). This study compared tip location using catheters with and without metallic guidewire, inserted to two different lengths in the epidural space of dog cadavers, assessed via computer tomography (CT).

Sixteen fresh greyhound cadavers were randomly allocated to receive epidural catheters with (W) or without (WO) guidewire. Each cadaver had two catheter placements at the lumbosacral intervertebral space, initially aiming towards the fifth lumbar vertebra (L5), then towards the third (L3). CT was used to evaluate the catheter tip's distance to the cranial aspect of the targeted vertebra (tip-target distance), presence of a loop, spinal canal exit, and quadrant location (dorsal–ventral, right–left). Wilcoxon signed-rank and Chi-square tests were used to compared continuous and binomial data respectively ($p < 0.05$)

No catheter exited the spinal canal, two catheters in the WO and one in W group looped ($p = 0.544$). Tip-target distance (WO group: 1.146 [-8.681 – 4.425] cm, W:-1.468 [-5.235 – 3.430] cm, $p = 0.779$) and tip-quadrant location were similar between groups ($p = 0.414$ and 0.476 for dorsal – ventral and right – left respectively). All looped catheters had ventral tip-quadrant locations. When W and WO were grouped and analysed per vertebra targeted, tip-target distance was also similar (L5: -1.275 [-8.620 – 1.540] cm, L3: -1.708 [-8.681 – 1.326] cm, $p = 0.367$). There was no difference in lateralisation ($p = 1$), but more catheter tips (7/16) ended in ventral quadrants when advanced to L3 than to L5 (2/16) ($p = 0.049$).

Most epidural catheters fell short of the target vertebra. None exited the spinal canal, but three looped. Advancing the catheter to L3 increased the likelihood of ventral positioning Further research is needed to determine the clinical implications.

**Reference**

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5020

# Evaluating capture of isoflurane from anaesthetised horses

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Capturing volatile agents to prevent environmental contamination (and eventual repurposing) is beginning to be adopted in small animal practices in the UK. A single study recently identified an isoflurane capture efficiency of 65% in cats and dogs (White et al. 2025). The full environmental and economic cost of capture is unclear.

We evaluated the efficiency of capture and in vivo mass transfer (MT) in anaesthetised horses using isoflurane (VET-can, SageTech Veterinary, UK). Purposeful sampling at one UK equine hospital was used to recruit enough horses to fill two Vet-cans. The VET-can was positioned downstream of the anaesthetic breathing system (Bird Mark 7, JDMedical) before the active gas scavenging system. The primary outcome was capturing efficiency (isoflurane delivered: desorbed, %). *In vivo* MT was calculated by weighing the VET-can and vaporiser before and after each anaesthetic. The secondary outcomes were correlations between MT and patient characteristics and anaesthesia variables. Anaesthesia was induced with ketamine and midazolam following acepromazine, morphine and romifidine. Horses received isoflurane (ETISO 1.3-1.5%) in 100% oxygen. Horses' lungs were ventilated to normocapnia, and dobutamine infused to maintain MAP> 60mmHg. All horses received intraoperative romifidine (40mcg kg hour$^{-1}$) and intravenous fluid therapy. Volatile hygiene measures were employed (leak checking, cuff inflation), and the breathing system was capped at the end of the procedure. Appropriate parametric or nonparametric statistical analyses were used.

Eighteen horses were recruited to the study, 6 horses filled can 1 (745 minutes: fill rate of 84%), efficiency of capture was 44% volatile and 17% water. Twelve horses filled can 2 (1418 minutes: fill rate of 109%), efficiency of capture was 35% volatile and 8% water. Median *in vivo* MT was 47% (19 - 60). Post disconnection capture from the anaesthestic circuit increased MT by 1.5-3.4%.

Future studies evaluating factors affecting equine capture are indicated.

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5021

# Effect of early discontinuation of lidocaine infusion on accelerometry-based equine recovery from isoflurane general anesthesia: a randomized clinical trial

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The impact of discontinuing lidocaine infusions 30 minutes before the conclusion of inhalant anesthesia on equine recovery has not previously been evaluated.

Forty healthy adult horses anesthetized for MRI received a standard anesthetic protocol. A lidocaine loading dose of 2 mg $kg^{-1}$, followed by a continuous rate infusion of 3 mg $kg^{-1}$ $hour^{-1}$, were administered. Horses were randomly assigned to either discontinue the infusions 30 minutes before the end of anesthesia (Group D, n = 20), or continue it until the end (Group C, n = 20). A 3-axis accelerometer was secured around the withers, where the maximum velocity per second ($Vmax = \sqrt{(x^2+y^2+z^2)}$; x, y, and z equal axial accelerations for each axis (m $s^{-2}$)) was associated with each standing attempt and used to calculate an objective recovery score (RS; excellent (11 to 30), good (31 to 50), fair (51 to 70), poor (71 to 90), or unacceptable (≥ 91)).

Time to first movement, time to sternal recumbency, time to standing, and number of standing attempts were recorded. Data were analyzed using a student's t-test and a Wilcoxon test for parametric (mean ± standard deviation) and non-parametric data (median (range)), respectively, with the significance set at 0.05.Times to first movement, sternal recumbency, and standing were 43 (21 - 69) minutes, 56 (29 - 90), 61 (29 - 111); and 33 (21 - 69), 45 (26 - 97), 50 (36 - 97), for groups C and D, respectively ($p > 0.200$). The number of stand attempts were 1 (1 - 5) for both groups ($p = 0.823$). RS were 22 ± 7 and 25 ± 8 for Groups C and D, respectively ($p = 0.175$).

There was no evidence that discontinuing lidocaine infusions 30 minutes before ending inhalational anesthesia, compared to continuing it until the end, enhanced recovery quality.

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# AM404, an active metabolite of acetaminophen provides local anesthesia in rats via nociceptor specific sodium channel blockade.

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Despite its wide use, the mechanism of action of acetaminophen remains unknown. AM404, an active metabolite of acetaminophen, may provide analgesia peripherally via inhibition of nociceptor specific voltage gated sodium channels (NaV).

AM404 10mM or vehicle (DMSO, tween-20 & saline) were administered intraplantar in naïve male and female Sprague Dawley rats or following complete freund's adjuvant (CFA), formalin or capsazepine injections. Mechanical (MWT) and thermal withdrawal thresholds (TWT) were examined at baseline and from 15 to 120 minutes post administration and normalized to the contralateral limb and baseline. A current clamp was used to examine the effect of AM404 on the excitability of trigeminal ganglion nociceptive neurons. A voltage clamp was used to measure sodium currents in ND7-23 cells expressing NaV1.7 and HEK293 cells expressing NaV1.8. Two-way ANOVA with corrections for multiple comparisons were performed to compare treatments between groups. Significance was set at $p < 0.05$.

AM404 inhibited action potential firing in nociceptive neurons, ex vivo. In in vitro expression systems, AM404 blocked sodium currents with an IC50 of 41 ± 24nM for NaV1.7, and 65 ± 36nM for NaV1.8. In vivo, in naïve animals mean (± standard deviation) MWT was higher following AM404 at 30 and 60 minutes (1.29 ± 0.27, 1.42 ± 0.83 respectively) compared to vehicle (0.93 ± 0.34, 0.97 ± 0.21) and TWT at 60 minutes (1.33 ± 0.39 vs 1.04 ± 0.21). Following formalin administration MWT was higher with AM404 compared to vehicle at 60 minutes (0.94 ± 0.66 vs 0.55 ± 0.41). MWT was higher 60 minutes after AM404 when administered two days following CFA (0.37 ± 0.12 vs 0.13 ± 0.05).

This study demonstrates that AM404 provides local analgesia via nociceptive specific NaV. This elucidates a peripheral mechanism of acetaminophen analgesia and may be a future tool for pain specific loco-regional anesthesia.

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# Endoscopic evaluation of tracheal mucosal cuff site trauma following intubation with a 26.0 mm ID silicone endotracheal tube in adult horses – preliminary results

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Previous studies have correlated endotracheal tube (ETT) diameter and intracuff pressure (Ferreira et al. 2021) and intubation duration with tracheal injury in horses (Parente et al. 2025). This study aims to further explore influences on tracheal injury in horses.

Thirteen horses were intubated using minimum occlusive volume (MOV) technique with silicone 26.0 mm ETTs and positioned in dorsal or lateral recumbency. Video endoscopy was performed before intubation and after extubation and tracheal mucosal injury was later visually scored using an ordinal scoring system adapted from Parente et al. (2025). Intracuff pressure was recorded every 20 minutes from cuff inflation until extubation. Recorded variables included bodyweight (kg), intracuff pressure (mmHg), intubation time (minutes) and tracheal injury scores. Shapiro – Wilk analysis was performed for data normality and Pearson's correlation was used between mucosal injury score and intubation time, intracuff pressure and bodyweight.

Intracuff pressures were 160 ± 22 mmHg (range 136 – 210). Median change in tracheal injury score (post – pre) was 7 (IQR 2) and pre-intubation and post-extubation were 0 (IQR 0) and 7 (IQR 2) respectively. All horses (n = 13) demonstrated tracheal injury post extubation. Pearson's correlations between change in tracheal injury score and intubation time, intracuff pressure and bodyweight were (R = 0.563, p = 0.045), (R = - 0.097 p = 0.752) and (R = - 0.246 p = 0.417), respectively.

| | n | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Intracuff pressure (mmHg) | 13 | 136 | 210 | 160 | 22 |
| Intubation time (mins) | 13 | 50 | 152 | 117 | 32 |
| Bodyweight (kg) | 13 | 440 | 669 | 561 | 62 |

Table 1: preliminary analysis results for the thirteen horses

Preliminary results indicate that intubation time may be positively associated with greater tracheal damage in horses intubated with high pressure low volume 26.0 mm ETTs. There was no correlation between tracheal injury score and bodyweight or intracuff pressure.

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5061

# Evaluation of the analgesic efficacy of local infiltration of levobupivacaine and bupivacaine, with or without tramadol, in a rabbit femoral fracture model

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Local infiltration with levobupivacaine and bupivacaine is underutilized in orthopedic pain management, and few studies have evaluated their efficacy (Perets et al., 2018; Korat et al., 2017). This study aimed to assess the effects of surgical wound infiltration with levobupivacaine or bupivacaine, with or without systemic tramadol, on vital signs and pain scores in a rabbit femoral fracture model. The study protocol was approved by the Animal Experiments Ethics Committee of Atatürk University, Erzurum, Turkey (decision no: 2023/02).

Forty-eight male New Zealand White rabbits underwent femoral shaft osteotomy and intramedullary pin fixation. Animals were randomly assigned to six groups (n = 8): Group C received 0.25 mL of 0.9% saline locally; Group T received saline plus intramuscular tramadol (5 mg/kg) every 8 h for 3 days; Group B received 0.25 mL of 0.5% bupivacaine locally; Group BT received bupivacaine plus tramadol; Group L received 0.25 mL of 0.5% levobupivacaine locally; Group LT received levobupivacaine plus tramadol. Pain was assessed using the Rabbit Grimace Scale, HR, fR, PR, $SpO_2$, RT, MAP, blood glucose, and cortisol at baseline and at 2, 4, 6, 12, 24, 48, and 72 hours postoperatively. All animals were closely monitored, and rescue analgesia was administered if pain scores exceeded predefined thresholds. Parametric data were analyzed using repeated measures ANOVA with Bonferroni correction ($\alpha = 0.05$), and pain scores using Kruskal-Wallis and Dunn's tests.

HR remained stable in all groups except for a significant decrease in LT. MAP declined over time, without intergroup differences. Cortisol levels were lowest in LT at 8 hours. Pain scores in LT and BT were significantly lower than in other groups ($p < 0.05$).

In conclusion, local infiltration of levobupivacaine or bupivacaine, particularly when combined with tramadol, provided effective and safe postoperative analgesia in rabbits undergoing orthopedic surgery.

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5081

# Comparison of atracurium administered as a variable rate infusion or as intermittent boluses in dogs undergoing ophthalmic surgery

**Conrado Borja Sanchez Martinez**, Ignacio Redondo Garcia, Eva Rioja Garcia

This study retrospectively compared atracurium administered as a variable rate infusion (VRI) versus intermittent boluses (ITB), to assess total atracurium dose, neuromuscular function and recovery time in dogs undergoing ophthalmic surgery.

A retrospective analysis was performed on 48 anaesthetic records of dogs (24 per group based on a priori sample size calculation) meeting the inclusion criteria (body weight ≥5 kg; BCS 3-8/9; ocular procedures lasting over 60 minutes). Neuromuscular function was assessed with acceleromyographic train-of-four ratio (TOFr). Data recorded included body weight, total accumulated atracurium dose normalised to surgery time, time of TOFr between 0.2-0.7, time to recover 90% of baseline TOFr and requirement for neuromuscular blockade reversal. Continuous variables were compared using t-tests and categorical data were analysed using Fisher's exact test ($p < 0.05$).

A significant difference was found in the total accumulated normalised dose of atracurium between the VRI (mean 4.22 ± 1.23 µg/kg/min) and ITB (mean 5.5 ± 2.13 µg/kg/min) groups ($p = 0.011$). The median (IQR) time with a TOFr 0.2-0.7 was 20 (43) min in VRI versus 5 (5) min in ITB. Notably, the VRI group exhibited a significantly shorter 90% TOFr recovery time (mean 13 ± 6 min) than the ITB group (mean 42 ± 14 min; $p < 0.0001$). Although fewer dogs in the VRI group required reversal of neuromuscular blockade (only 2 versus 7 in ITB), this difference did not reach statistical significance ($p = 0.14$).

The infusion regimen of atracurium is associated with a lower total required dosage, less deep neuromuscular blockade and faster neuromuscular recovery compared with intermittent boluses. These findings suggest that a VRI approach offers a clinical advantage by avoiding deep levels of neuromuscular block and enhancing speed of neuromuscular recovery.

5083

# Attitudes of veterinarians in the Republic of Ireland towards acute pain assessment and management in cats and dogs

**Chiara Cipollini**[1], Flavia Restitutti[1], Sean Lacey[2], Claire Loughran[1], Vilhelmiina Huuskonen[1], Rachel Bennett[1]

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Effective recognition and treatment of pain are essential for ensuring animal welfare. This study investigated the attitudes of veterinarians practising in the Republic of Ireland (ROI) towards their assessment and management of acute pain in cats and dogs.

An anonymous online survey, comprising five sections, was accessible to veterinarians. It requested demographic information, analgesic drug availability, use of pain assessment tools, pain scoring and treatment of pain associated with specific procedures in dogs and cats. Statistical inferences were interpreted using a 5% level of significance.

A total of 181 responses [140 female (77.3%), 39 male (21.5%)] were collected between January and December 2024. Female veterinarians were more likely to use pain scoring tools in both dogs ($p = 0.029$) and cats ($p = 0.031$), and to prescribe lidocaine in dogs ($p = 0.007$) compared to males. Postgraduate training was associated with an increased use of pain scoring tools in cats ($p = 0.003$) and a higher likelihood of prescribing ketamine in both species ($p = 0.013$). Veterinarians who graduated in the 2010s were more likely to use pain scoring tools in dogs compared to those who graduated in the previous decade ($p = 0.016$). Pain score tools were routinely used by 40.9% and 45.9% of practitioners in dogs and cats respectively. Practitioners employing pain scoring systems were also more inclined to prescribe opioids, use adjunctive analgesia, and implement loco-regional techniques in both species. Most respondents reported routinely administering NSAIDs and opioids. This drug combination was used in 90.1% and 82.9% of canine and feline ovariohysterectomies respectively.

This survey highlights increased use of multimodal analgesia and pain scoring tools among female veterinarians, recent graduates, and those with postgraduate training. NSAIDs and opioids are the most commonly prescribed combination for managing acute pain in small animals by veterinarians in the ROI.

5084

# Pharmacokinetics and postoperative analgesic efficacy of intravenous acetaminophen in dogs undergoing laparoscopic ovariohysterectomy

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Paracetamol is increasingly used as part of multimodal analgesia in dogs (Bello and Dye 2023), but its pharmacokinetics (PK) and analgesic efficacy after multiple doses remain underexplored. This study assessed its postoperative analgesic effects, PK, pharmacodynamics (PD), and safety in female dogs undergoing laparoscopic ovariohysterectomy.

A randomized, blinded trial compared IV paracetamol (10 and 20 mg $kg^{-1}$ every 8 hours) with buprenorphine (20 µg $kg^{-1}$ every 8 hours) for 24 hours. First administration was at the moment of extubation. Pain was assessed using the Glasgow Composite Measure Pain Scale – Short Form (CMPS-SF) up to 24 hours. Pharmacokinetics and PD were evaluated by nonlinear mixed-effects modelling to characterize drug disposition, define plasma concentration thresholds for analgesia, and model pain score evolution over time. The PK parameters were compared between breeds and doses (Mann–Whitney U test) and PD parameters were compared between treatment groups (Kruskal-Wallis test and the Mann–Whitney U test for a post hoc analysis). Hematological, hepatic and renal parameters were obtained before and 24 hours after treatment and were compared (Wilcoxon signed-rank test). Significance if $p < 0.05$.

Fifty-nine dogs were included. Paracetamol at both doses provided analgesia comparable to that of buprenorphine, with CMPS-SF scores maintained mainly between 0 and 2 (Fig. 1). Pharmacokinetic was described by a two-compartment model, with paracetamol maximum plasma concentration of 11.49 (2.16) and 19.78 (5.18) µg mL-1 and minimum of 0.11 (0.07) and 0.24 (0.21) µg mL-1 at 10 and 20 mg $kg^{-1}$ respectively. The PD model described the cumulative probability of low scores demonstrating a long-lasting analgesic effect. The drug was well tolerated and no adverse effects were observed.

Paracetamol at 10 and 20 mg kg-1 produces effective postoperative analgesia at the study conditions without side effects. Further studies are warranted to refine dosing strategies and assess broader clinical applications.

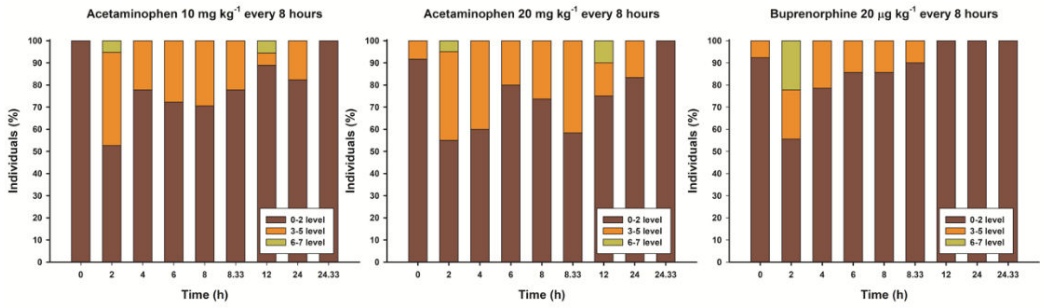


Figure 1.
Analgesic score levels by the CMPS-SF scale defined as percentage of individuals over the time grouped by three thresholds, from 0 to 2 in brown colour, from 3 to 5 in orange colour and from 6 to 7 in green colour.

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5090

# Five-minute exposure to EMLA cream reduces pain response to intravenous catheterisation in calves

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The Eutectic Mixture of Local Anaesthetics (EMLA) cream is a topical anaesthetic containing 2.5% lidocaine and 2.5% prilocaine. In humans, this eutectic formulation enhances the local absorption of active ingredients, thereby increasing its analgesic efficacy (Kopecky et al., 2001). EMLA cream is widely used in human medicine to desensitize the skin prior to venipuncture, reducing procedural discomfort (Rogers & Ostrow, 2004). The objective was to assess whether 2- and 5-minute exposure periods to EMLA cream could reduce pain-related behavioural responses during IV catheter placement in calves.

A total of 60 Holstein calves were enrolled in the study as part of a planned disbudding procedure. Calves were randomly assigned to four groups: EMLA or placebo cream with an exposure period of either 2 or 5 minutes (n = 15 per group). Following the allocated exposure time, an intravenous catheter was placed in the jugular vein, and behavioural responses were scored using a 0–3 scale. Data were analysed using Mann–Whitney U tests.

All calves completed the study without adverse effects, and no signs of secondary dermal toxicity were observed in any group. The reaction scores did not differ significantly between the EMLA 2 group and the Placebo 2 group (median [range]: 1 [0–3]; p = 0.57). However, a significant difference was observed between the EMLA 5 group (0 [0–2]) and the Placebo 5 group (1 [0–3]; p = 0.01).

This study demonstrates that a 5-minute exposure to EMLA cream effectively reduces behavioural reactions in calves during IV catheterisation. Based on these findings, a 5-minute exposure period may be recommended for use in veterinary practice to improve the welfare of calves undergoing intravenous procedures.

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5100

# A retrospective study of propofol requirements for induction of anaesthesia in paediatric and geriatric dogs and cats.

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The aim of this study was to investigate the propofol requirements for induction of anaesthesia in paediatric, adult, and geriatric dogs and cats.

Retrospectively, 3,266 dogs and 606 cats induced with propofol were grouped according to premedication (presence or absence of an a2-agonist) and age (0 - 11 weeks, 11 weeks - 6 months, 6 months - geriatric and geriatric).

In the a2-agonist premedicated dogs, statistically significantly increased requirements of propofol were noted for neonatal (median 4.28, range 2.22 - 9.76 mg kg-1) and paediatric (3.8, 1 - 15.38 mg kg-1) dogs compared to the other groups [adult (2.1, 0.24 - 18.6 mg kg-1) and geriatric (1.61, 0.2 - 5.88 mg kg-1)] and a decrease in requirements in geriatric dogs when compared to the other groups. In a2-agonist premedicated cats, significant differences were observed between all groups [neonatal (median 10, 7 - 14 mg kg-1), paediatric (4.22, 1.76 - 15.63 mg kg-1), adult (2.22, 0.58 - 6.67 mg kg-1) and geriatric (1.87, 0.32 - 3 mg kg-1)]. In dogs premedicated without an a2-agonist, neonatal and paediatric dogs had significantly higher requirements for propofol (5.71, 2.88 - 16.67 and 5.12, 2.35 - 14, respectively) when compared to adult (2.92, 0.24 - 15.22) and geriatric (2, 0.38 - 9.38) dogs, with geriatric having decreased requirements when compared to all other groups. In cats premedicated without an a2-agonist, neonatal (9.71, 4 - 34) and paediatrics (8.47, 5 - 14.29) had significant differences both with adult (3.2, 1 - 8.33) and geriatric (1.95, 1 - 2.94) cats, with geriatric having significantly lower requirements than all other groups.

Neonatal and paediatric dogs and cats seem to require a higher dose of propofol for induction of anaesthesia when compared to adults and geriatrics, while geriatric patients seem to require a lower dose compared to other groups.

5115

# A retrospective analysis of a single veterinary private practice canine population, treated with bedinvetmab (LibrelaTM)

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Bedinvetmab is a monoclonal antibody targeting nerve growth factor labeled in the European Union for the alleviation of pain associated with osteoarthritis (OA) in dogs. An initial retrospective case series was collected from a private French veterinary practice and characterizes dogs receiving this treatment. Bedinvetmab was used in a diverse patient population; preexisting comorbidities were common.

Dogs were treated between January 2021 and December 2024. Those with OA pain from ≥ 1 site and treated with ≥ 1 injections of bedinvetmab were included. Data were analyzed using descriptive statistics. Pain scores were assessed using a modified client-specific outcome measures (mCSOM; scale: 0–12). Cases from 206 dogs (mean 11, SD ± 3 years) were reviewed having received injections of bedinvetmab (median 3; range 1–34).

The hip (47%) and stifle (28%) joints were most affected, while getting up (38%) and lameness associated with walking (33%) were the most often defined mCSOM criteria. Breed, sex, age, or OA location did not impact initial mCSOM reductions. Initial mCSOM scores (before injection) did not differ significantly across analgesic treatments (63%; NSAID: 9.7 ± 1.7, Gabapentin: 8.3 ± 2.5, Both: 9.5 ± 1.9) compared to no-treatment group (37%; 9.6 ± 1.4). Preexisting comorbidities in descending order; Urinary, Neurologic, Cardiac, Dermatologic, Orthopedic, Cancer, Endocrine) were already present in 26% of dogs. New ones variably developed in 25% of dogs (in descending order; proprioceptive and motor disorder, , Gastric, Urinary, Dermatologic, Cardiac, Cancer) over the 3-year period. A subset of dogs (88/206) had initial mCSOM scores on Day 0, 10 and 30 and demonstrated a 48% decrease in mean mCSOM scoring (9.6; range 7.9-11.3 to 5; range 4-6) within 10 days which continued over the next 20 days.

This initial summary highlights the need for additional prospective review to further investigate these preliminary trends.

5150

# Evaluation of low-dose medetomidine-vatinoxan and butorphanol combinations for sedation in canine radiographic procedures.

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A new 1:20 medetomidine-vatinoxan formulation has recently entered the market, but the sedative and cardiovascular effects of low doses combined with butorphanol remain unclear. This study aimed to compare two low-dose regimens of the combination in dogs undergoing orthopaedic radiographic procedures.

Sixteen healthy dogs were randomly assigned to two equal groups and received IM butorphanol (0.15 mg $kg^{-1}$ ); in addition, group M-0.125 received IM medetomidine (0.125 mg $m^{-2}$) and vatinoxan (2.5 mg $m^{-2}$ ), while group M-0.25 received IM medetomidine (0.25 mg $m^{-2}$ ) and vatinoxan (5 mg $m^{-2}$). Sedation was assessed using a 21-point scale at 5-minute intervals, with scores > considered moderate sedation (Grint et al. 2009). At the same time points, HR, and MAP were recorded. If sedation was inadequate, propofol was titrated to effect for restraint, and dose recorded. Sedation time was measured from head-down onset until dogs spontaneously returned to sternal position post-procedure. Student's t-test analyzed differences between groups, and a linear mixed model was used to evaluate HR, and MAP over time. Statistical significance was set at $p < 0.05$.

Dogs weighed 2.5–45 kg. Fifteen minutes after sedation onset, the score was > 15 and remained at this level for additional 15 minutes, with no differences between groups ($p = 0.967$). Sedation lasted 57 ± 11 minutes in group M-0.125 and 63 ± 17 minutes in group M-0.25 ($p = 0.462$). No difference in propofol doses was detected ($p = 0.550$); six and seven dogs in groups M-0.125 and M-0.25 required propofol 15 minutes after sedatives administration. The HR significantly decreased over time ($p < 0.001$), although MAP remained above 65 mmHg in all dogs throughout the sedation period.

This study suggests that the doses of medetomidine and vatinoxan combining with butorphanol provides acceptable sedation and cardiovascular stability for orthopedic radiographs in dogs.

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5151

# Standardised anaesthetic protocol and complications during transcatheter occlusion of patent ductus arteriosus in dogs: A retrospective cohort study of 24 cases (2024)

**Denise Tabacchi Fantoni**[1], Adan William de Melo Navarro[1], Mayara Travalini Lima[1], Daniele Midori Kakimoto Higa[1], Gabrielly Moreira dos Santos Oliveira[1], Guilherme Teixeira Goldfeder[2], Renata Sayuri Akabane[1], Alessandro Rodrigues de Carvalho Martins[1]

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Patent ductus arteriosus (PDA) is a congenital vascular anomaly resulting from the failure of closure of the ductus arteriosus. Its treatment options include surgical occlusion through thoracotomy and minimally invasive transcatheter occlusion. While transcatheter approaches are increasingly preferred, detailed anaesthetic reports using standardised protocols are scarce. To describe the anaesthetic management and intraoperative complications in 24 dogs undergoing transcatheter PDA occlusion, all managed with a single standardised anaesthetic protocol.

Medical records of dogs treated in 2024 were retrospectively reviewed. Anaesthetic monitoring included heart and respiratory rate, ECG, invasive blood pressure, $SpO_2$, and $EtCO_2$. Hypotension was considered when mean blood pressure values were below 60 mmHg, and hypertension was above 100 mmHg. Most dogs received methadone premedication (91,6%), followed by induction with etomidate, midazolam, lidocaine, and fentanyl (100%) and maintenance with isoflurane. Statistical analysis was performed using the Wilcoxon test to compare pre- and post-occlusion cardiovascular parameters. A significance level of $\alpha \leq 0.05$ was adopted to determine statistical differences.

Median surgical time was 110 minutes. Bradycardia occurred in 10 dogs (41,6%) treated successfully with one dose of atropine. Hypotension was observed in 19 cases (79.9%) and corrected with vasopressors. One case of hypertension was managed with sodium nitroprusside. Branham's sign occurred transiently in one patient. No significant change was observed in heart rate ($p = 0.796$) or systolic arterial pressure ($p = 0.107$), but mean and diastolic arterial pressures increased significantly post-occlusion ($p = 0.028$ and $p = 0.015$, respectively).

Transcatheter PDA occlusion in dogs, when conducted under a standardised anaesthetic protocol using cardiovascular stable agents such as etomidate, midazolam and fentanyl, resulted in mild and manageable hemodynamic changes. This approach reinforces the importance of protocol selection and the careful selection of drugs with minimal cardiovascular depression. Careful monitoring and individualised vasoactive planning are also essential.

5187

# Sedative and antinociceptive effects of xylazine vs dexmedetomidine in New Zealand white rabbits

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Xylazine has been used in cardiac electrophysiology studies in rabbits (Odening et al. 2008). We aimed at comparing sedative and antinociceptive effects of xylazine and dexmedetomidine.

Forty-seven New Zealand White rabbits, admitted for intra-aortic, trans-coronary gene therapy via carotid cannulation and short-term aortic arch occlusion, were randomly assigned to receive either Xylazine 4 mg kg-1 (group X) or Dexmedetomidine 100 µg kg-1 (group D), combined with S-Ketamine 15 mg kg-1 and Buprenorphine 0.02 mg kg-1 SC. Fifteen minutes later, sedation was scored. After general anaesthesia induction, airways were secured with an endotracheal tube or, in case of failure, a laryngeal mask. Anaesthesia was maintained with S-Ketamine and either Xylazine (2.25 mg kg-1 hour-1) or Dexmedetomidine (10 µg kg-1 hour-1). If MAP or fR increased at least 20% from baseline during surgery, rescue analgesia was administered. Sedation (0 = no sedation to 11 = deep sedation) and intubation (0 = excellent to 14 = very difficult) scores were compared between groups using Mann-Whitney test. The likelihood of administering further sedation (score < 7), rescue analgesia, and of failed tracheal intubation was assessed with relative risk (rR) followed by Fischer exact test. $P \leq 0.05$ was deemed significant.

The likelihood of administering further sedation was higher in group X than D (rR = 3.136, p = 0.013). The likelihood of failed tracheal intubation (rR = 0, p =0.237) and rescue analgesia (rR = 2.976, p = 0.22) was not significantly different. Sedation was deeper in group D (median 9, IQR 8 - 10) than in group X (median 7, IQR 4 - 9, p = 0.048). Intubation score in group D (median 5, IQR 2.25 – 7.75) and in group X (median 4.5, IQR 1.75 - 9) were not different (p = 0.704).

Dexmedetomidine provided deeper sedation without better antinociception than xylazine.

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5195

# Comparison of the prevalence and location of trigger points in dressage and show-jumping horses

**Camilla Schiesari**[1], Karine Portier[1], Lisa Gauthier, Lin Tchia Yeng, Denise Tabacchi Fantoni, Maira Rezende Formenton

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Myofascial trigger points (MTrPs) are localized, hypersensitive areas in muscles that can cause pain and reduced performance. Despite their clinical significance in humans, limited data are available in equine athletes. This study aimed to compare the prevalence and location of MTrPs in show jumping and dressage horses. A secondary objective was to evaluate the potential of thermography, pressure algometry, and facial expression scoring in characterizing MTrPs.

Fourteen horses (7 dressage, 7 show jumping) were examined. Muscle manual palpation was used to identify MTrPs, and involved the palpation of hypercontractile nodules, with a typical "twitch" response, defined as a transient visible or palpable contraction of the muscle fibers in response to pressure. Pressure algometry (Instrutherm® Dd-500) was applied perpendicularly to the skin at 1 kg $cm^{-2}$ $s^{-1}$ until the horse showed signs of discomfort. Thermography was used to compare the skin surface temperature of MTrPs with adjacent control areas (located at less than 10 cm from the MTrP). Additionally, facial expressions were recorded during palpation using the Horse Grimace Scale (HGS).

MTrPs were found in all horses. Both groups showed a high prevalence (> 60%) of MTrPs in the back. Dressage horses had a higher prevalence of MTrPs in the neck (17%) and a lower prevalence in the rump (17%) than show-jumping horses (3% and 30% respectively). Temperatures at MTrPs were significantly higher than at control points ($p < 0.01$). Median minimum, mean, and maximum temperatures at MTrPs were 34.2°C (29.5–37.6), 35.0°C (30.4–38.2), and 35.6°C (31.0–38.8), respectively, compared to 33.0°C (31.8–36.0), 33.8°C (32.6–36.3), and 34.8°C (33.6–36.6) at control sites. Facial expression scores were also higher during MTrPs palpation compared to control (16 [0–24] vs 6 [0–19], $p = 0.004$).

These findings open a perspective for better recognition of myofascial pain in horses.

5200

# Anesthetic mortality in canine patients in a veterinary teaching hospital in Spain: a retrospective study.

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Despite the latest advances in anesthetic techniques, anesthesia can still lead to complications and death. The study of its associated risk factors is key to improving anesthetic safety, particularly when analyzed in a specific institution.

2,158 canine patients were included in a longitudinal retrospective cohort study. Anesthetic and medical records from patients anesthetized from January 2013 to December 2019 at the Veterinary Teaching Hospital of Alfonso X el Sabio University were evaluated. Records were studied from premedication to 48 hours post-extubation. Parameters recorded included demographic data, therapeutic/diagnostic procedure and its duration, anesthetic drugs administered and American Society of Anesthesiologist (ASA) classification of patients, among others. Anesthetic mortality was defined as spontaneous deaths occurred during the defined study period.

Anesthetic-related mortality rate was 0.4%. The highest proportion of anesthetic deaths (37.5%) occurred in Boxer dogs. 87.5% of procedures with anesthetic mortality were emergency interventions, exploratory laparotomy showing the highest incidence (table 1). Deaths occurred in patients classified as ASA III to ASA VE. 50% of deaths occurred 24 hours post-extubation (table 2). 75% of deceased dogs only received methadone during premedication.

The anesthetic mortality rate observed, and its associated risk factors, are consistent with current research. These initial data suggest that the incidence of anesthetic-related mortality in our institution is similar to that currently reported internationally and that introduction of extra safety features in the anesthetic management of patients with identified risk factors may be warranted.

**Table 1.** Type of procedure, duration and emergency status

| Emergency procedure | n | Mean ± SD |
|---|---|---|
| Gastric dilatation-volvulus (GDV) | 1 | 200 ± NA |
| Endoscopy | 1 | 25 ± NA |
| Exploratory laparotomy | 3 | 66 ± 9 |
| Pyometra | 1 | 80 ± NA |
| Thoracotomy | 1 | 132 ± NA |
| **Non-emergency procedure** | **n** | **Mean ± SD** |
| Enucleation | 1 | 55 ± NA |

SD: standard deviation; NA: not applicable

**Table 2.** Time of death

| | % (n) |
|---|---|
| Intra-anesthetic | 37.5 (3) |
| 24 hours post-extubation | 50.0 (4) |
| 48 hours post-extubation | 12.5 (1) |

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5203

# Flow-control expiration (FLEX) for large animals achieved by a gate valve

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Flow-controlled expiration (FLEX) improves pulmonary function in anesthetized horses, however, is only available in one commercial large animal anesthesia workstation. The aim of this study was to test whether a polyvinylchloride 2-inch gate valve could generate FLEX ventilation (FLEXV).

The valve was placed on the expiratory limb of a large animal breathing circuit. Its aperture was manually adjusted to achieve continuous flow throughout the entirety of the expiratory phase. Two polypropylene barrels simulating horse lungs were ventilated with an ascending-bellow ventilator using FLEXV or conventional ventilation. The barrels were also ventilated with the original FLEX. Respiratory mechanics variables including peak expiratory flow (PEF), mean airway pressure (Pmean), area under the scalar curves of airway pressure (AUCPaw) and volume (AUCVol), and dissipated energy were recorded and compared between conventional, FLEXV and FLEX ventilation at identical settings of respiratory rate and tidal volume. Respiratory mechanics data were compared among conventional ventilation, FLEXV, and the original FLEX using descriptive statistics.

The manual adjustment of FLEXV could be performed by visual assessment of the ventilator below. Ventilation with FLEXV provided lower PEF and energy dissipated than in conventional ventilation (-1.9 vs -6.1 L second–1; 0.69 vs 1.69 J, respectively), with values similar to the FLEX (-2.3 L second–1 and 0.68 J). Ventilation with FLEXV was associated with AUCPaw, AUCVol and Pmean higher than in conventional ventilation (22258 vs 11656; 5109 vs 1922; and 9.9 vs 6.5 cmH2O, respectively). The AUCPaw of FLEXV was similar to FLEX (28043). The AUCVol of FLEXV was intermediate between conventional and FLEX (9736) and Pmean was lower in FLEX (6.8 cmH2O).

The addition of FLEXV to a large animal ascending below ventilator was able to generate flow and pressure patterns similar to the original FLEX, potentially offering an inexpensive and widely accessible alternative to the computer-controlled version.

5219

# Addition of adrenaline to irrigation fluid in diagnostic and therapeutic arthroscopy in dogs: an anesthetic approach

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Systemic absorption of adrenaline has been reported in human arthroscopies (Abdelrahman et al., 2021). This study investigated whether similar absorption occurs in dogs, using cardiorespiratory variables and biochemical markers (McGuinness et al., 1997; Mansour et al., 2017).

A prospective, randomized clinical study was conducted on 41 joints in dogs undergoing diagnostic stifle (n = 20) or therapeutic elbow (n = 14), shoulder (n = 5), and stifle (n = 2) arthroscopies. All dogs received medetomidine (0.01 mg $kg^{-1}$) and methadone (0.2 mg $kg^{-1}$) IM, ketamine (1 mg $kg^{-1}$) and propofol to effect IV, and maintained with isoflurane. Locoregional anaesthesia was performed. Ringer-Lactate (RL) was used as irrigation fluid during the first two minutes. Subsequently, each procedure type was divided into RL with adrenaline (0.33 mg $L^{-1}$) or RL alone (control group). Cardiorespiratory variables (HR, SAP, MAP, DAP, fr) and parasympathetic tone activity (PTA; based on HR variability) were recorded at baseline (T0), after optic insertion (T2), and every 5 minutes (T5, T10, T15 and T20 for diagnostic; until T60 for therapeutic). Plasma concentrations of glucose, cortisol, and adrenaline were measured at T0, T20, and 20 minutes post-procedure (Tend20). Statistical analysis was performed using R (v4.4.2). Generalised linear models were applied to assess the effects of group, time, and their interaction. Significance was set at $p < 0.05$.

No significant differences between groups or over time were found in cardiorespiratory variables ($p > 0,05$), PTA ($p = 0.80$), or glucose ($p = 0.78$). Cortisol and adrenaline increased significantly at T20 in diagnostic procedures (1.15 ± 0.79 vs. 4.95 ± 2.48 $nmolL^{-1}$ at T0 vs T20, $p = 0.007$; 33.87 ± 20.35 vs. 94.06 ± 143.50 $pgmL^{-1}$, $p = 0.041$), but without group differences.

Adrenaline at 0.33 mg $L^{-1}$ in arthroscopic irrigation fluid caused no significant systemic effects, suggesting minimal absorption.

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5247

# Comparison of pain in ovariectomy: laparoscopy vs midline celiotomy under an opioid-free protocol (OFA) in dogs

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Laparoscopic ovariectomy is associated with faster recovery, Lee et al (2013). However, conflicting data exist regarding intra- and postoperative pain. This study aimed to compare both techniques using an OFA protocol.

A prospective, randomized, blinded trial was conducted with 25 healthy female dogs assigned to ovariectomy via laparoscopy (LAP) or midline celiotomy (CEL). The OFA protocol included dexmedetomidine (5 µg kg -1, IM), tramadol (3 mg kg -1, IM), propofol dose effect. Anesthesia was maintained with isoflurane. Intraoperative monitoring included HR, fr, blood pressure, ECG, Fe´$CO_2$, SpO2, temperature, and end-tidal isoflurane (Dräger® monitor). Anesthetic depth was assessed clinically. Fentanyl (5 µg kg -1 IV) was administered if any parameter increased by>% from baseline at T1 (basal), T2 (trocarization/incision), T3/ T4 (right/ left ovary dissection). Carprofen was administered postoperatively. Glasgow Composite Measure Pain Scale and Mechanical nociceptive testing (MNT, Von Frey, Ugo Basile®) were assessed 2, 4, 8, and 24 hours after extubation for evaluating postoperative pain, and hyperalgesia, respectively. Two-way ANOVA was used for MNT, and Fisher's exact test for intraoperative rescue. Significance was set at $P < 0.05$.

Intraoperative rescue analgesia was required in 6/12 (50%) dogs 3/13 (23%) in the LAP and in the CEL group, respectively (Figure 1). Although numerically different, this was not statistically significant. MNT decreased slightly at 8 hours in both groups (Figure 2), with no significant difference. All postoperative pain scores remained <6/24.

Laparoscopy and celiotomy resulted in comparable intraoperative and postoperative pain outcome under an OFA protocol. While the protocol provided effective postoperative analgesia, additional intraoperative analgesic support may be necessary, particularly during ovarian manipulation. Neither technique showed a clear advantage in terms of pain severity.

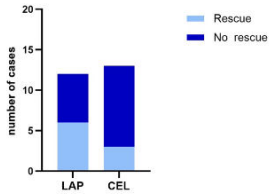


Figure 1: Frequency of intraoperative rescue/no rescue analgesia, 6/12 (LAP) and 3/13 (CEL)

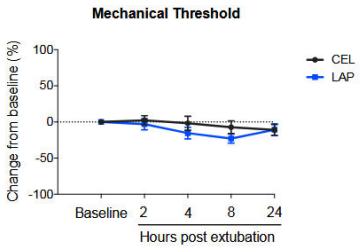


Figure 2: MNT (% change from baseline, mean ±SEM)

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5270

## Evaluation of acepromazine's impact on tissue oxygen saturation in horses sedated with detomidine using near-infrared spectroscopy

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Near-infrared spectroscopy (NIRS) measures tissue oxygenation saturation (StO2). This study compared the effects of IV detomidine (D) and detomidine-acepromazine (DA) on StO2 in horses.

A group of eight healthy adult horses received IV detomidine (10 µg kg–1) alone or combined with acepromazine (20 µg kg–1) in a randomized crossover design with a one-week washout. The NIRS probe was placed on the sartorius muscle to measure StO2 before (0), and 5, 15, 30, 60, and 120 minutes after drugs administration. At the same time, sedation was scored using FaceSed. Mixed-effects linear models were used to evaluate treatment effects over time, with horse as random effect, time, treatment and their interaction as fixed effects.

Sedation scores were overall significantly higher in the DA group (Table 1). In both treatments, $StO_2$ significantly decreased over time with no differences between groups (Figure 1).

Acepromazine enhanced sedation but did not appear to improve $StO_2$ in horses.

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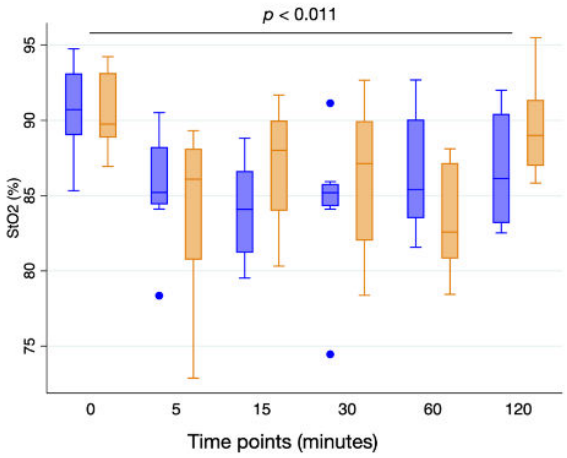
**Figure 1** Tissue oxygen saturation ($StO_2$) before and after IV administration of 10 µg $kg^{-1}$ of detomidine (blue) with or without 20 µg $kg^{-1}$ acepromazine (orange) in eight horses.



5271

# Single-site ventral distal paravertebral block results in successful paralumbar fossa anesthesia in steers

**Madeline Butterfield**[1], Earl Ford[1], Maggie Mooring[1], Blanca Camacho[1], Lydia Love[1], Kelley Varner[1]

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Traditional approaches to paravertebral anesthesia in cattle require multiple injections. We hypothesized that a single-injection ventral distal paravertebral block (VDPB) to the L1 transverse process would create paralumbar fossa anesthesia and complete staining of the targeted nerves versus injection at L2.

Seven healthy Holstein steers were used in this randomized, blinded, crossover study design. Each steer received a VDPB using 6 mg/kg of 2% lidocaine with methylene blue injected at L1 or L2 on either side. Onset and extent of anesthesia were assessed by response to 1 cm deep needle pricks along a typical paralumbar fossa incision site. Steers were euthanized as part of an unrelated study and dissected to characterize stain deposits of the T13, L1, and L2 spinal nerves. Fisher's exact test assessed the success of paralumbar fossa anesthesia and the total number of spinal nerves successfully stained using the two approaches.

For L1 injections, 6/7 (85%) were successfully anesthetized, and spinal nerves T13, L1, and L2 were successfully stained in 6/7 (85%), 7/7 (100%), and 7/7 (100%) of steers. For L2 injections, 6/7 (85%) were successfully anesthetized, and spinal nerves T13, L1, and L2 were successfully stained in 1/7 (14%), 6/7 (85%), and 6/7 (85%) of steers. Total block success was 78%. There was no significant difference in successful blockade between groups. T13 was significantly more likely to be stained with an L1 approach ($p = 0.01$).

Single-site VDPB injection at either location resulted in anesthesia of the paralumbar fossa.

5279

# To determine the effect of the application of ice to the skin overlying the infraorbital canal on conscious equine patient compliance to infraorbital nerve block placement under standing sedation

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Infraorbital nerve block placement in awake horses is difficult due to the noxious nature of this stimulus resulting in pronounced head movements. The authors hypothesize that patient compliance will improve by icing the area overlying the infraorbital canal prior to block placement.

Ten healthy adult horses weighing 532 ± 41 kg were studied in a blinded, randomized, crossover trial. Each horse acted as its own control, receiving two treatments three weeks apart. For each treatment horses were sedated using detomidine. Sedation level was evaluated using a published simple descriptive scale1 to ensure clinically similar sedation between horses. Horses were assigned to receive five minutes of “ICE” (icing skin overlying the infraorbital canal) or five minutes of “NO ICE” (room temperature material placed on skin overlying the infraorbital canal) prior to block placement. A retrograde infraorbital nerve block was performed using 5 ml of mepivacaine. Block efficacy was tested using a muzzle needle prick. Each horse received the opposite treatment three weeks later. Nerve blocks were filmed and reviewed by two blinded investigators who scored patient compliance using a visual analogue scale, with 0 = Non-compliance and 10 = Total compliance. Reviewer scores were added for a total score out of 20 for each treatment. A paired t-test was performed to compare groups.

Mean ± SD of “ICE” and “NO ICE” were 15.2 ± 3.9 and 12.67 ± 6.4 respectively. There was no statistically significant difference between groups. The block was unable to be performed in two horses with “NO ICE”. Ten successful blocks were performed with “ICE”.

Icing did not significantly improve patient compliance when performing an infraorbital block.The small number of horses included in this study, along with the fact that two horses did not tolerate the block at all without icing, potentially warrants conducting a larger study.

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5280

# Development of a novel ensemble machine learning model for predicting post-anesthetic hypoxemia in mechanically ventilated dogs

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Post-anesthetic hypoxemia remains a critical complication associated with mortality in dogs (Duffee et al. 2023). Artificial intelligence (AI) could be used for early risk detection and safer anesthesia. This study aimed to develop a novel ensemble machine learning (ML) model to predict post-anesthetic hypoxemia and identify key predictors.

This retrospective, single-cohort study included dogs presented between January–June 2022 at Seoul National University Veterinary Medical Teaching Hospital with written owner consent. Dogs undergoing inhalational anesthesia with invasive blood pressure monitoring were included; duplicate or incomplete cases were excluded. Twenty-four features from pre-anesthetic examinations, intra-anesthetic monitoring and recovery were used as input. Mild hypoxemia ($PaO_2$ <80 mmHg, Ortlieb et al. 2025) measured during recovery via the arterial catheter was the outcome. The Synthetic Minority Over-sampling Technique was selectively applied to generate synthetic cases, and address class imbalance (hypoxemic versus non-hypoxemic), using class probability thresholds. A combination strategy for ensemble learning based on boosting algorithms, optimized for categorical data, was used. ML analyses used Python with PyTorch and scikit-learn libraries. Feature significance was assessed using t-tests and chi-squared tests, with $p < 0.05$ considered significant.

The dataset included 149 dogs fulfilling inclusion criteria and 211 generated cases. A validation set (16 dogs per class) was drawn from the original data; hypoxemia occurred in 10.7%. The final model achieved 88.4% accuracy and an area under the receiver operating characteristic curve of 0.890. Brachycephalic breed, pulmonary compliance, left lateral recumbency, tidal volume and peak airway pressure were key predictors (ranked by importance), all showing significant group differences ($p$ = 0.00001–0.00625).

Despite the small sample size and retrospective design, the proposed ML model showed strong discriminative ability, suggesting clinical applicability for early identification of dogs at risk of post-anesthetic hypoxemia. Identified features could facilitate early detection and prevention of anesthesia-related respiratory complications.

This research was supported by the New Faculty Startup Fund from Seoul National University, and the BK21 FOUR program and Research Institute of Veterinary Science, College of Veterinary Medicine, Seoul National University. This work was also supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (MSIT) (RS-2024-00456480).

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5288

# Evaluation of laryngeal obstruction and edema using the endotracheal tube cuff leak test in dogs: clinical trials

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This study evaluated whether the cuff leak test (CLT), which compares expiratory tidal volumes with and without endotracheal cuff inflation under positive-pressure ventilation can identify dogs at risk of upper airway obstruction.

Client-owned dogs undergoing non-respiratory computed tomography under general anesthesia were prospectively enrolled with informed owner consent. To reduce anatomical variation and obtain standardized data, endotracheal tube (ETT) sizes of 5.0–6.0 mm were selected. Pre-anesthetic thoracic radiographs were used to estimate optimal ETT size, which was validated on CT by assessing tracheal-to-tube diameter compatibility at the cuff level. All dogs were managed under a standardized anesthetic protocol, including constant rate infusions of remifentanil (10 μg/kg/h), midazolam (0.02 mg/kg/h), and ketamine (0.3 mg/kg/h), followed by induction with propofol (6 mg/kg), maintenance with sevoflurane, and invasive arterial pressure monitoring via the dorsal pedal artery. The cuff leak test (CLT) was performed immediately after discontinuation of inhalant anesthesia, with expiratory tidal volumes measured six times using the flow sensor of the ventilator. The average values under cuff-inflated ($V_1$) and cuff-deflated ($V_2$) conditions were used to calculate the cuff leak percentage (CLP) as $(V_1 - V_2)/V_1 \times 100$. Arterial blood gas analysis was performed 10 minutes post-extubation in room air ($FiO_2$ 0.21). Dogs with $PaO_2$ <80 mmHg were assigned to the obstructiongroup.

Differences in CLP between groups were analyzed using the Mann–Whitney U test. In dogs (n = 10, 5 per group), body weights ranged from 2.9 to 9.8 kg, Median CLP was significantly lower in the obstruction group (0.09%, range: 0.03–0.22%) compared to the control group (53.2%, range: 16.2–56.7%), and this difference was statistically significant ($p$ = 0.036).

These findings suggest that the CLT may be a clinically useful tool for identifying dogs at risk of post-extubation laryngeal obstruction.

This research was supported by the New Faculty Startup Fund from Seoul National University, and the BK21 FOUR program and Research Institute of Veterinary Science, College of Veterinary Medicine, Seoul National University.

5296

# Evaluation of anesthetic effects of intramuscular administration of alfaxalone with ketamine or midazolam in Hy-Line W36 roosters.

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This study assessed intramuscular (IM) injectable anesthetic protocols for maintaining a surgical plane of anesthesia in roosters.

Sixty healthy roosters were randomly assigned to one of four treatment groups (n = 15/group). Treatment MA1 (midazolam 1 mg $kg^{-1}$ and alfaxalone 20 mg $kg^{-1}$ IM) and KA1 (ketamine 10 mg $kg^{-1}$ and alfaxalone 20 mg $kg^{-1}$ IM) were assessed first, and increasing dosages were implemented in treatments MA2 (midazolam 1 mg $kg^{-1}$ and alfaxalone 22 mg $kg^{-1}$ IM) and KA2 (ketamine 15 mg $kg^{-1}$ and alfaxalone 20 mg $kg^{-1}$ IM). All roosters were premedicated with butorphanol 2 mg $kg^{-1}$ IM. Cecectomy surgeries were performed once a surgical plane of anesthesia was achieved. Data were analyzed using an analysis of covariance (SAS 9.4) and with significance at $P \leq 0.05$ and separated using Fisher's LSD; surgeon served as covariant.

Anesthesia duration differed significantly among MA1 and MA2 ($P < 0.0001$). MA2 had the longest duration (41.67 min), followed by MA1 (28.78 min). Both MA1 and MA2 differed significantly from KA1 (9.35 min) and KA2 (14.98 min). No significance occurred between KA1 and KA2, despite dosage increase. All of the MA2 roosters reached a surgical plane of anesthesia, while only 11 of 15 roosters in MA1 reached surgical depth. KA1 and KA2 protocols were insufficient, with 3 roosters combined reaching surgical depth; most required immediate isoflurane supplementation.

These results support the butorphanol-midazolam-alfaxalone combination as a viable injectable protocol for chickens. In contrast, butorphanol-ketamine-alfaxalone is inadequate for achieving a surgical plane of anesthesia.

5298

# Antinociceptive effects of the abdominis rectus sheath block with 0.2% bupivacaine in anesthetized horses

**Eutalio Pimenta**[1], Stephanie Dantino[2], Daniel Sakai[2], Matheus Rocha[3], Rachel Reed[1], Jane Quandt[2], Michele Barletta[1]

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The rectus abdominis sheath (RAS) block, when performed on standing horses, provides antinociception (Ishikawa et al., 2023); however, its efficacy when performed in recumbent horses remains unclear.

Six adult horses were anesthetized twice using a standardized isoflurane-based protocol, receiving bilateral 2-point RAS injections (1 mL kg-1) of either 0.2% bupivacaine (BT) or 0.9% NaCl (ST) under ultrasound guidance in a randomized crossover design. Thereafter, the horses remained anesthetized for one hour. The HR, fr, ataxia score (AS, 0 to 4 scale), and mechanical nociceptive threshold (MNT) using a 1 mm diameter tip that protruded remotely (triplicate measurement midway the xyphoid and umbilicus were recorded at baseline and from 2 to 10 hours post-Baseline values were compared using paired t-tests and Wilcoxon tests. The post-block effects of treatment, time, and their interaction were analyzed with generalized linear mixed models ($\alpha = 0.05$).

Baseline HR, fr, and AS for ST and BT were 35 ± 6 and 31 ± 3 beats minute-1, 19 ± 2 and 17 ± 3 breaths minute-1, and 0 and 0, respectively. Similar HR, fr, and AS were observed during the post-block period. The baseline MNT was similar between ST (13.3 ± 3.4 N) and BT (15.1 ± 1.5 N). Post-block, the estimate MNT (95% confidence interval) was 13.7 (10.0, 18.8) and 22.2 (16.2, 25.0) N for ST and BT, respectively ($p < 0.001$) without an effect of time or the interaction of time with treatment.

The RAS block provided antinociception without adverse outcomes during the studied period.

**Reference**

Ishikawa Y, Sakai DM, SY Im J et al. (2023) Antinociceptive effects of bupivacaine injected within the internal abdominis rectus sheath in standing healthy horses. Vet Anaesth Analg 50, 294-301.

5302

# Modulation of joint inflammation and synovial repair by dipyrone versus carprofen in a rat early monoarthritis model

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Dipyrone has been classified as an anti-inflammatory for years, but no clear evidence exists beyond its action on cyclooxygenases.

We induced monoarthritis in male Wistar rats through by intra-articular mBSA/CFA injection. Rats were randomly assigned to a control group (healthy animals), two arthritis control groups (8-day and 13-day arthritis treated with tramadol 17.8 mg/kg SC), and 13-day arthritis treatment groups: low-dose dipyrone (177.8 mg/kg SC q8h), high-dose dipyrone (500 mg/kg SC q24h), or carprofen (10 mg/kg SC q24h). Arthritis was maintained for 8 or 13 days for assessment. We evaluated morphological changes (inflammation and synovial healing), cellular activity via [18F]FDG-PET/CT, PGE2 concentrations, lameness/inflammation/pain scores, and analgesic rescue. Additionally, we assessed the behavior and adverse effects on the stomach, liver, kidneys, and bone marrow. Data were analyzed using two-way ANOVA and Friedman test.

The morphological evaluation showed that treatment with dipyrone resulted, in a dose-dependent manner, in reduced inflammation and accelerated the synovial repair process through type I collagen fibers, while carprofen diminished the inflammatory infiltrate with less synovial repair than dipyrone. Dipyrone prevented the increase in type V collagen fibers, which are immunogenic and antigenic, unlike the other treatments. All treatments showed increased cellular activity assessed by [18F]FDG-PET/CT compared to the control; however, only dipyrone treatment decreased this activity on day 13 (2,2 ± 0,6; 1,7 ± 0,3 and 2,5 ± 0,8; 1,8 ±0,5). PGE2 concentrations were elevated compared to control only in TR8 and TR (19,4 ± 10,7; 126,2 ± 80,1; 135,0 ± 105,4). No significant differences were observed among the groups regarding behavior, lameness/inflammation/pain scores, analgesic rescue, and adverse effects.

In conclusion, administering dipyrone at low or high doses may reduce inflammation, promote synovial repair, and prevent immunogenicity, highlighting its role in the modulation of joint inflammation in a rat model of early monoarthritis induced by mBSA/CFA.

5305

# The Effects of Canine ABCB1-1Δ Mutation on Common Pre-anesthetic Medication Combinations

**Kristen Deom**, Bonnie Hay-Kraus, Craig Willette, Emily Wheeler

The ABCB1-1Δ mutation impairs P-glycoprotein (p-gp) function, altering drug distribution and increasing risk of adverse effects. Butorphanol, maropitant, and acepromazine are p-gp substrates, but limited clinical data on use in affected dogs exist (Mealey et al. 2023). We hypothesized administering multiple p-gp substrate medications would produce more pronounced sedation and alteration in cardiovascular parameters (non-invasive blood pressure (BP), HR) in affected dogs.

Twenty-three client-owned dogs were grouped by ABCB1-1Δ genotype: 11 Normal/Normal (N/N) and 12 Mutant/Normal (M/N). All dogs underwent two treatments in a blinded, prospective, crossover design: maropitant 1 mg $kg^{-1}$ IV followed one hour later by either butorphanol 0.2 mg $kg^{-1}$ and acepromazine 0.02 mg $kg^{-1}$ or butorphanol 0.4 mg $kg^{-1}$ and acepromazine 0.04 mg $kg^{-1}$ IV, with a five-day minimum washout. Sedation score (SS), BP, HR, fr, and temperature (T) were obtained at baseline, one hour after maropitant alone, and for six hours after butorphanol and acepromazine (sedative) administration. Data were analyzed using linear mixed-effects models and Type III ANOVA ($p = 0.05$).

Mean SS changed significantly over time ($p < 0.001$) after but not before sedative administration, with higher sedative dose ($p < 0.05$), but not genotype ($p = 0.9$), increasing SS significantly. Significant differences occurred in HR, fr, MAP, and DAP between baseline and all times after sedative administration ($p = 0.005$, $p < 0.001$, $p < 0.001$, $p < 0.001$, respectively), with no significant effect of genotype or dose. SAP changed significantly over time after sedative administration ($p < 0.001$) and was affected significantly by dose ($p < 0.05$) but not genotype ($p = 0.12$).

Maropitant (1 mg $kg^{-1}$ IV) alone did not cause significant sedation in M/N or N/N dogs compared to baseline. Heterozygous ABCB1-1Δ genotype did not significantly impact SS, HR, fr, BP, or T in dogs administered either combination of acepromazine and butorphanol.

5332

# Effects of increased resistance to gas flow on the tidal volume delivered by pressure-controlled ventilation: an in vitro simulation for cats

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Decreased respiratory system compliance and increased airway resistance will decrease the tidal volume (VT) delivered during pressure-controlled ventilation (PCV). This study aimed to evaluate the effects of increased resistance to gas flow, caused by progressive decreases in ETtube(ID), on the expired VT (VTexp) recorded during PCV using an in vitromodel for cats.

The ventilator, adjusted to deliver an inspiratory pressure of 5 cmH2O (inspiratory time 2 seconds, rise time 1 second, zero end-expiratory pressure, 100% FiO2), was connected to a test lung. The VTexp and expiratory resistance (Rexp) were recorded as the endotracheal tube internal diameter (ETtube(ID)) was decreased from 4.5 (ETtube(4.5)) to 3.5 (ETtube(3.5)) and 2.5 mm (ETtube(3.5)) (n = 6 for each ETtube(ID)), with compliance of the test lung adjusted to 8 and 4 mL cmH2O-1. A two-way ANOVA followed by Tukey and Bonferroni tests analyzed data ($p < 0.05$)

As compliance was decreased from 8 to 4 mL cmH2O-1 the VT(exp) was decreased by 44.8 to 48.8% ($p < 0.0001$). With compliance set at 8 mL cmH2O-1, decreases in ETtube(ID) from 4.5 to 2.5 mm significantly increased Rexp(cmH2O Liter-1second-1) from 38.6 ± 1.3 to 86.3 ± 4.8 (123.6% increase, $p < 0.0001$); while VTexp (mL) decreased from 38.9 ± 0.7 to 36.0 ± 0.2 (7.5% decrease, $p = 0.0004$). With compliance set at 4 mL cmH2O-1, Rexp significantly increased from 54.4 ± 11.7 (ETtube(4.5)) to 104.5 ± 3.5 (ETtube(2.5)) (92.1% increase, $p < 0.0001$), while VTexp significantly decreased from 21.3 ± 0.4 to 18.4 ± 0.6 (13.6% decrease, $p = 0.0004$).

Contrasting with the major reductions in VTexp caused by decreased compliance, major increases in resistance to gas flow, caused by decreases in ETtube(ID) from 4.5 to 2.5 mm, result in mild to moderate decreases VTexpduring PCV.

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# Mass balance, methaemoglobin and metabolite study of [14C]paracetamol after IV and oral administration in dogs

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The use of intravenous and oral paracetamol in dogs is increasing, however a drug development programme is needed to establish safety and efficacy. This study aims to determine the mass balance, routes and rates of excretion following a single oral administration of [14C]paracetamol to male Beagle dogs and compute pharmacokinetic parameters of total radioactivity in whole blood, blood cells and plasma.

Two adult male dogs were used in a two-period crossover study (Project license PP1414329). In the first period, IV paracetamol was administered at 10 mg $kg^{-1}$ with methaemoglobin (Siemens Rapid point 500) measured in whole blood, and samples of plasma and urine collected at intervals up to 48 hours. [14C]paracetamol at 10 mg kg (100 µCi $kg^{-1}$) was orally administered in the second period, with total radioactivity in whole blood, blood cells and plasma evaluated and concentrations of paracetamol within plasma measured. Urine, faeces and cage washings were collected up to 168 hours post-dose for mass balance and metabolite analysis.

Total recovery of administered radioactivity over 168 hours was 85.4% and excretion mainly occurred during the first 48 hours. The majority of the radioactive dose was recovered from urine (73.0%), faeces (5.65%) and cage washes (6.7%). Small increases in methaemoglobin were observed within 1 hour post-dose (from 0.9 - 1% to 1.4 - 1.5%) and methaemoglobin returned to baseline at 6 hours. The mean Cmax for total radioactivity measured 10.3, 7.9 and 13.5 µg equivalent $g^{-1}$ in whole blood, red blood cells and plasma respectively, between 0.5 and 1 hour post-dose. Average blood-to-plasma ratio was 72%. Concentrations of total radioactivity were still well above the limit of quantification at 48 hours post-dose.

The use of 14C radiolabel has allowed, for the first time, the routes of excretion and metabolic fate of paracetamol to be fully defined in the dog.

# Poster Abstracts

4694

## Pharmacokinetics of remimazolam compared to midazolam after intravenous administration to horses

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Remimazolam (RMZ) is a new short half-life benzodiazepine used in humans. This study compared the pharmacokinetics and sedative effects of RMZ with midazolam (MDZ), a benzodiazepine commonly used in Thoroughbred horses.

Six Thoroughbred horses received a single IV dose of RMZ 0.05 mg $kg^{-1}$ or MDZ 0.05 mg $kg^{-1}$ over 60 seconds in a randomized cross-over design. Blood samples were collected immediately after the end of dosing (0 minute) and at 5, 10, 20, 30, 45, 60, 90, 120, 180, 240 and 360 minutes after dosing, and plasma RMZ and MDZ concentrations were measured by LC-MS/MS. Concentrations were analyzed using a three-compartment model of a nonlinear mixed effect model. Wobble and stimulus responses were assessed every 5 minutes from the end of dosing and scored in 3 levels. Pharmacokinetic parameters were compared between RMZ and MDZ by using a paired t-test.

The mean pharmacokinetic parameters of RMZ and MDZ, respectively, were, for peak plasma concentration (Cmax), 76.6 ± 21.0 ng $mL^{-1}$ and 232.5 ± 105.7 ng $mL^{-1}$ in Cmax, 0.84 ± 0.13 hour and 3.94 ± 0.15 hour in terminal half-life, 14.0 ± 1.1 L $kg^{-1}$ $hour^{-1}$ and 0.45 ± 0.02 L $kg^{-1}$ $hour^{-1}$ in plasma clearance, 2.0 ± 0.3 L $kg^{-1}$ and 1.3 ± 0.1 L $kg^{-1}$ in steady-state volume of distribution, respectively. RMZ had a significantly shorter terminal half-life and higher plasma clearance than MDZ. Wobble and diminished stimulus response to RMZ and MDZ were observed immediately after administration until 5 minutes and 15 minutes later, and the response generally disappeared after 10 minutes and 20 minutes, respectively.

As in humans, the benzodiazepine RMZ was eliminated extremely rapidly in horses. Based on these pharmacokinetic parameters, the establishment of total intravenous anesthesia with RMZ for rapid and smooth recovery in horses is expected.

4705

# Can the Nose Outperform the Muscle? Pharmacokinetic Insights into the Use of Ketamine in Pigs

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Previous pharmacodynamic investigations in pigs, using data from the same randomized clinical trial, demonstrated that intranasal (IN) administration of a chemical restraint protocol produced faster onset and shorter duration of action compared to the intramuscular (IM) route, with comparable sedation quality (Rabelo et al., 2024). Building upon these findings, our objective was to evaluate ketamine pharmacokinetics following IN or IM administration of a drug combination for chemical restraint in pigs and assessed whether these parameters aligned with previous pharmacodynamic findings.

Twenty pigs were randomly assigned to receive IM or IN treatment (n = 10 each) with ketamine (7 mg $kg^{-1}$), azaperone (3 mg $kg^{-1}$), and midazolam (0.3 mg $kg^{-1}$). Mean body weight was 98.7 ± 12.5 kg (IM) and 99.6 ± 14.7 kg (IN). Pharmacokinetics were assessed by non-compartmental analysis (NCA) and population pharmacokinetics (PopPK) using PKAnalix® and Monolix®. Group comparisons used the t-test.

In NCA, the area under the curve from zero to infinity ($AUC_o$–inf) and the apparent volume of distribution relative to bioavailability (Vd $F^{-1}$) were lower in the IN group ($AUC_o$–inf: 91.6 ± 35.5 vs. 121.8 ± 23.9 mg $L^{-1}$ $h^{-1}$; Vd $F^{-1}$: 646.8 ± 310.9 vs. 1045.4 ± 484.3 L). The relative bioavailability of the IN route was 75 %. PopPK supported a two-compartment model, with absorption constant = 0.059 ± 0.009 $h^{-1}$, clearance = 7.7 ± 0.75 L $h^{-1}$, central volume = 53.5 ± 13.7 L, intercompartmental clearance = 8.7 ± 1.6 L $h^{-1}$, and peripheral volume = 662.7 ± 175.1 L.

Despite lower systemic exposure, the IN route demonstrated pharmacokinetic properties compatible with effective drug delivery. When interpreted considering our previous pharmacodynamic findings, these results suggest that IN administration may benefit from alternative absorption pathways, such as nose-to-brain transport, reinforcing its potential as a viable alternative to IM administration in pigs.

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4714

# Owner's understanding of anaesthetic risks - Preliminary data

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Pre-operative education has been shown to reduce parental anxiety and improve satisfaction in human pediatrics (Morrison et al. 2019). Better understanding owner's perceptions of anesthetic risks may enhance communication, patient safety, and client satisfaction.

This study used an online, voluntary anonymous survey presented to dog and cat owners admitted for elective procedures requiring general anesthetic (GA) at a small animal secondary and tertiary referral hospital. Descriptive, Chi-square, Mann-Whitney U, and McNemar's statistical tests were used to assess owner demographics, anesthetic risk awareness and discussion preferences.

Seventy-five responses were received representing owners of 56 dogs (74.7%) and 19 cats (25.3%), with a mean pet age of 6.53 ± 3.74 years. Death was the most frequently mentioned GA risk (65.3%), followed by respiratory complications (34.7%), gastrointestinal and drug related complications (24%). 9 (12%) owners were not aware of any GA related risks. BOAS-related complications were mentioned by 13 out of 17 brachycephalic breed owners. Previous pet GA experience was associated with increased awareness of death as a GA risk ($p = 0.033$). Owners that had personally had a GA before were significantly more familiar with several risks including difficult intubation ($p = 0.001$), respiratory depression ($p = 0.003$) hypothermia ($p = 0.024$) and hypoxia ($p = 0.009$). The risk of death was approximately 13 times more likely to affect owners' decision for consent compared to hypothermia (OR = 0.077, McNemar's $p = 0.034$). Death was also the anesthetic risk most owners wished to discuss with the veterinarian (61.3%), while hypotension, excitement on recovery and gastroesophageal reflux were the least frequently selected for discussion (14.7%). 16 owners (21.3%) indicated that they did not wish to discuss any anesthetic risks.

This study highlights varied owner awareness of anesthetic risks, highlighting the need for tailored communication to improve informed consent and client confidence.

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4716

# Inducing hypoxaemia in experimental adult pigs by varying $FiO_2$ with nitrogen.

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Veterinary anaesthetists can be usefully involved in animal experiments to i) ensure animal welfare ('refinement') and ii) manipulate physiological variables to achieve scientific objectives. ('reduction' i.e. reduce the animal numbers required) (Russell & Burch 1959). Insufficient methodological detail in scientific reports precludes experimental reproducibility (Kilkenny et al. 2009) so sharing successful methodology is another reductionary measure.

We describe a method for inducing hypoxaemia in adult pigs by varying $FiO_2$. Preanaesthetic medication in 3 Landrace X pigs was azaperone 4 mg $kg^{-1}$, ketamine 5 mg $kg^{-1}$ and dexmedetomidine 20 mg $kg^{-1}$ IM. Anaesthesia was induced with alfaxalone 0.15 – 0.41mg $kg^{-1}$ IV. The trachea was intubated with an experimental endotracheal tube with a pulse oximeter incorporated in the cuff. Anaesthesia was maintained with isoflurane in $O_2$ (fresh gas flow was 4 litres $min^{-1}$) alfaxalone 3mg kg $hr^{-1}$ and dexmedetomidine 2mg kg $hr^{-1}$. Pigs' lungs were ventilated to normocapnia. A metered flow of $N_2$ was introduced between the ventilator's supply gas inlet and circle system. Hypoxaemia was achieved by altering the $O_2$:$N_2$ flow ratio. The vaporiser setting was simultaneously altered to maintain $E'_{ISO}$ at 1.2%. Arterial blood gas analyses were performed during desaturation epochs to validate the endotracheal tube's pulse oximetry technology.

Reducing $FiO_2$ to 0.12 – 0.16% was readily achieved and reduced $PaO_2$. Recovery was rapid when the $O_2$:$N_2$ flow ratio was increased: the lowest recorded $PaO_2$ in one animal, 33.3 mm Hg increased to 425 mmHg within 5 minutes.

Modifying equipment to allow $N_2$ inflow and varying the $O_2$:$N_2$ ratio is a simple and inexpensive method for controlling $FiO_2$ in hypoxaemic pig models. These details will assist others involved in experiments requiring variable $FiO_2$.

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4730

# Ultrasound-guided pulsed radiofrequency of the canine hip joint capsule: a preliminary study

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This study aimed to evaluate the efficacy of a novel ultrasound-guided pulsed radiofrequency (PRF) technique targeting the canine hip joint capsule for the management of chronic osteoarthritic pain.

A total of four client-owned dogs with unilateral or bilateral hip osteoarthritis were enrolled. Dogs were anaesthetised and positioned in lateral recumbency. The lateral aspect of the hip capsule was virtually divided into five sectors. Ultrasound-guided PRF was applied to each sector, at 42°C for 10 minutes per site. To determine treatment efficacy and duration, Pain Severity Score (PSS), Pain Interference Score (PIS), and Quality of Life (QoL) were assessed by owners using the Canine Brief Pain Inventory (Brown et al. 2008) before treatment initiation (T0) and at one (T1), two (T2), four (T3) and twelve (T4) weeks post-treatment. Additionally, pain was evaluated by a non-blinded veterinary surgeon at monthly intervals, using a visual analogue scale (VAS). Data were analysed using the Shapiro-Wilk test and Student's t-test.

Baseline PSS (4.1 ± 0.5) was significantly higher than values recorded at T1(1.8 ± 0.9), T2 (2.3 ± 1), T3 (1.6 ±0.7) and T4 (1.9 ± 1.7). Baseline PIS (3.6 ± 0.6) was significantly higher than at T1(1.3 ± 0.7), T2 (1.5 ± 1.1) and T3 (1.4 ± 1.1). Compared with the baseline, the QoL improved at T4 in all but one dog. Basal VAS (6.7 ±1.9) was significantly higher than at T3 (3 ± 1.4). Ultrasound-guided PRF of the hip joint capsule was associated with a reduction of chronic pain due to osteoarthritis and with an improvement in QoL.

These preliminary results suggest a potential role for PRF of the hip joint capsule in managing chronic pain in dogs, although larger studies are warranted to confirm efficacy and define optimal treatment intervals and potential side effects.

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4732

# Comparison of Tiletamine-Zolazepam-Propofol admixture with propofol alone for induction of anesthesia in healthy adult dogs: a pilot study

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Tiletamine-Zolazepam is commonly used for canine anesthesia induction. However, its application as co-induction agent remains sparsely documented [Fernandez-Parra et al. (2018), Hampton et al. (2019)]. This pilot study compared the induction characteristics of a 1:1 tiletamine-zolazepam-propofol (TZP) admixture (9 mg $mL^{-1}$) versus propofol alone (10 mg $mL^{-1}$).

Ten healthy adult dogs followed a randomized crossover design with a 14-day washout. Following IM premedication with acepromazine (0.05 mL $kg^{-1}$), both treatments were administered IV via syringe driver (0.4 mL $kg^{-1}$ $min^{-1}$). Duration of sequences, total amount of drug, physiological parameters and quality of endotracheal intubation, anaesthesia and awakening were recorded.

A marked reduction in propofol dose was observed in the TZP group (4.1 ± 1.0 mg $kg^{-1}$) compared to the propofol group (7.5 ± 1.0 mg $kg^{-1}$). The TZP group exhibited a superior intubation quality (Figure 1), coupled by a reduced induction time (TZP: 2.17 ± 1.67 min, Propofol: 3.00 ± 1.02 min). HR, MAP and fr remained higher in the TZP group. Both groups showed comparable decreases in body temperature and similar anesthetic depth, with time to sternal recumbency longer in TZP group (TZP: 40.57 ± 20.53 minutes; Propofol: 33.10 ± 12.53 minutes). Recovery quality (scored 0-3) was deemed favorable in both groups (TZP: 0.68 ± 0.24; Propofol: 0.54 ± 0.26).

These findings suggest that the incorporation of tiletamine-zolazepam into a canine anaesthesia induction protocol may permit a reduction in the propofol dose, concurrent with enhanced intubation quality and attenuated cardiovascular depression compared to sole propofol administration. The clinical significance of these observations necessitates further investigation within a broader clinical context.

Figure 1: Quality of intubation Acknowledgements: The study was funded by Virbac.

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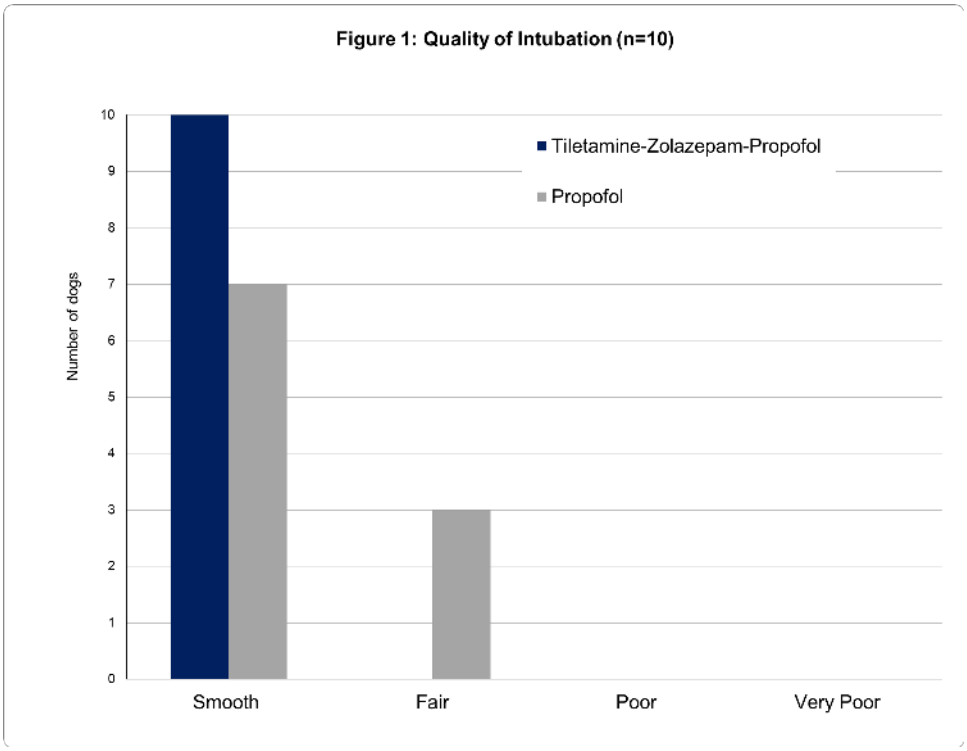
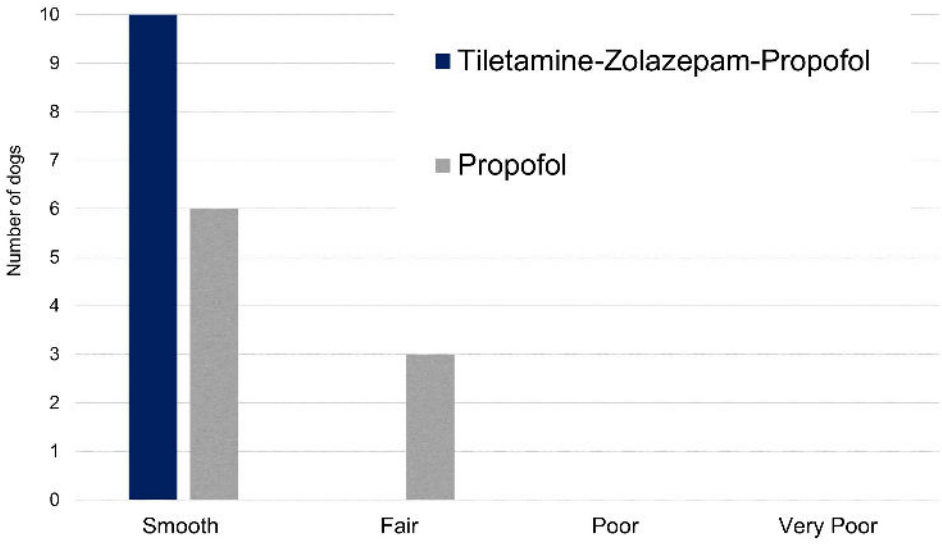



Figure 1: Quality of Intubation



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# Evaluation of Tissue Oxygen Saturation using Near-Infrared Spectroscopy in Horses Anesthetized with Two Fluid Administration Strategies

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This study aims to evaluate the effects of two different fluid administration strategies on peripheral tissue oxygenation ($StO_2$) in isoflurane-anesthetized horses using near-infrared spectroscopy.

A group of 16 adult horses undergoing experimental celiotomy were anesthetized using intravenous xylazine (0.5–1 mg $kg^{-1}$), ketamine (2.5 mg $kg^{-1}$) and midazolam (0.1 mg $kg^{-1}$), and maintained with an expired isoflurane concentration of 1.1–1.3%. Lidocaine (1.3 mg $kg^{-1}$ bolus, followed by 50 µg $kg^{-1}$ $minute^{-1}$) was administered. Dobutamine was infused to maintain mean arterial pressure (MAP) between 70–80 mmHg. Horses were randomly allocated to receive Hartmann's Solution at 2.5 mL $kg^{-1}$ $hour^{-1}$ (MNT) or 40 mL $kg^{-1}$ $hour^{-1}$ (OHD) for 120 minutes. The extensor carpi radialis muscle was used to monitor $StO_2$ through anesthesia. Measurements were recorded at baseline, 60 and 120 minutes after fluid initiation. Data were analyzed with mixed-effect linear regression, and correlations between $StO_2$ and physiological variables were assessed.

Baseline $StO_2$ was higher in the MNT group [median (interquartile range; IQR) 91% (90–92%)] than the OHD group [87.5% (85–89.6%), p = 0.027]. Peripheral tissue oxygenation increased over time in both groups (p = 0.019), with no significant group-time interaction (p = 0.47). Mean arterial pressure was higher in the OHD group at 60 and 120 minutes (p = 0.009, p = 0.007), but central venous pressure was also higher at 120 minutes. Weak but significant correlations were observed between $StO_2$ and MAP (rho = 0.36; p = 0.05) and serum lactate (rho = 0.36; p = 0.05). No significant associations were found with heart rate, cardiac output, dobutamine rate or central venous oxygen saturation, or venous partial pressure of oxygen.

$StO_2$ improved over time regardless of fluids rate and may reflect perfusion status during anesthesia, but further studies are warranted.

**Acknowledgment**

Arden and Claudia Sims Colic Research

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4795

# Evaluation of a Syndecan-1 ELISA for use in dog urine to investigate glycocalyx degradation following cardiopulmonary bypass in dogs.

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The endothelial glycocalyx, vital for health, is damaged by cardiopulmonary bypass (CPB) in children (Nussbaum et al., 2015). Urinary syndecan-1 is a marker of glycocalyx health (Ferrer et al., 2018).

Urinary syndecan-1 changes were investigated in client-owned dogs undergoing CPB for mitral valve repair (Oct 22-May 24). Following informed consent, samples were collected via urinary catheter (induction, T1, q2hr until recovery: T2, T3, T4), centrifuged, and supernatant frozen -80ºC until analysis (Mar 25). Canine ELISA (MyBiosource) quantified urinary syndecan-1, assay range 100 ng $mL^{-1}$ – 1.56 ng $mL^{-1}$. Urinary creatinine (µmol $mL^{-1}$) was measured (Jaffe IDMS Traceable Method A) and syndecan-1/creatinine ratio calculated. Preliminary ELISA validation included dilutional parallelism, inter- and intra- assay variability (coefficient of variance, CV).

Twenty dogs were enrolled, yielding 77 samples (median 4/dog). Validation showed good intra-assay variability (n = 8; 3.06 ng $mL^{-1}$, CV = 8.2%). Dilutional parallelism was poor (Table 1). Inter-assay highlighted one significant outlier (n = 8; 5.5 and 19.78 ng $mL^{-1}$, CV = 77.6 and 74.9%). Clinical samples from the same dog were evaluated in duplicate on a single plate; 41 samples (53.2%) were below the limit of quantification (Table 2).

This ELISA demonstrates poor inter-assay variability, a matrix effect in the absence of prior extraction, and insufficient sensitivity to detect changes in urinary syndecan-1 following CPB in dogs.

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## Tables

**Table 1**

| Dog | Sample | Dilution Factor | Syndecan-1 Concentration (ng/mL) | Recovered (%) |
|---|---|---|---|---|
| 1 | 1 | 0.5 | 5.94 | 100 |
| | 2 | 0.25 | 4.91 | 165.5 |
| | 3 | 0.125 | 3.87 | 260.9 |
| 2 | 1 | 0.5 | 21.00 | 100 |
| | 2 | 0.25 | 11.91 | 113.4 |
| | 3 | 0.125 | 8.22 | 156.5 |

**Table 2**

| Sample | Time | Samples (n) | Quantifiable samples (n) | Median (IQR) Syndecan-1 (ng/mL) | Median Urinary Syndecan-1/Creatinine ratio | IQR Urinary Syndecan-1/Creatinine ratio |
|---|---|---|---|---|---|---|
| T1 | Induction | 20 | 0 | - | - | - |
| T2 | 2hr | 20 | 9 | 1.75 (1.52-2.78) | 2.21 | 0.88-5.99 |
| T3 | 4hr | 20 | 15 | 2.31 (1.76-3.57) | 3.70 | 2.58-5.47 |
| T4 | 6hr | 17 | 8 | 6.21 (3.31-10.65) | 5.75 | 4.32-7.35 |

4800

# Comparison of bilateral cervical plexus block versus continuous rate infusion analgesia in dogs undergoing ventral slot surgery: a retrospective study

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This retrospective study compared the analgesic efficacy of an ultrasound-guided bilateral cervical plexus block (BCPB) (Cañón-Pérez et al. 2024) versus the use of continuous rate infusion (CRI) in dogs undergoing ventral slot surgery. Objectives included assessing the need for intraoperative rescue analgesia (RA), the time from premedication to first RA (TP-RA) and the influence of lesion location—cranial or caudal to 5th cervical vertebrae—on RA.

The anaesthetic records of twenty-two dogs were included. The last anaesthetic records prior to the implementation of BCPB for these surgeries were selected for the CRI group. Eleven received BCPB with 0.25–0.33% bupivacaine (0.15–0.3 mL kg-1 site-1), and eleven received CRI of fentanyl, ketamine, lidocaine, or dexmedetomidine in various combinations. All dogs were premedicated with methadone; seventeen also received an α2-agonist. Anaesthesia was induced with propofol and ketamine and maintained with sevoflurane. RA was defined as intraoperative boluses of fentanyl and/or ketamine in response to nociceptive signs. Fisher's exact and Mann–Whitney U tests were used (p-value < 0.05 was considered significant).

No significant differences were found in weight, gender and premedication. RA was required in 7/11 (63.6%) dogs in the CRI group and 6/11 (54.5%) in the BCPB group, though the difference was not significant (p = 1). TP-RA was 200 (60-257 minutes) and 110 (76-140 minutes) for BPCB and CRI groups, respectively. The difference was not statistically significant (p-value = 0.055). Lesion location had a significant impact: 9/10 (90%) dogs with caudal lesions required RA versus 4/12 (33.3%) with cranial lesions (p-value = 0.001). When analyzed separately, this association remained significant in the CRI group (p-value = 0.003) but not in the BCPB group (p-value = 0.266).

The BCPB provides analgesia comparable to systemic CRI in these surgeries. Further studies are needed to define the potential advantages of the BCPB.

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4801

# Ultrasound- and CT-guided trigeminal neurolysis for palliative management of refractory oncologic pain in a dog

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Oncologic pain is often difficult to manage, particularly in non-hospital settings. Although locoregional techniques are available, their duration of effect is frequently limited. Neurolytic procedures have been employed in both human and veterinary medicine to provide prolonged analgesia in cancer-related pain (Hjalmarsson et al., 2023; Koyyalagunta and Burton, 2010).

A 5-year-old, 25 kg castrated male mixed-breed dog was diagnosed with an aggressive maxillary fibrosarcoma. Following a left hemimaxillectomy, enucleation, and chemotherapy, local tumour recurrence was identified six months later. The dog was presented with severe pain, including anorexia, vocalization, and behavioral changes. Systemic analgesia consisting of NSAIDs failed to improve the patient's condition. To enhance quality of life, trigeminal nerve neurolysis was performed under general anaesthesia. The sphenoid complex was identified via ultrasound using the technique described by Viscasillas et al. (2017). Computed tomography (CT) was used to confirm the appropriate distribution of the neurolytic agent and to exclude intracranial migration (Figure). Chemodenervation was performed using a 5:1:1 mixture of 98% alcohol, 0.5% bupivacaine, and iohexol, respectively. To minimize potential side effects, the mixture was administered in 1 ml aliquots,, each followed by CT evaluation of its distribution. A total volume of 3 ml was delivered.

The patient was discharged the same day. A Spanish-translated version of the Ohio State University Quality of Life Scale was completed by the owners, comparing the two weeks before (27 points) and after the procedure (101 points). Owner feedback indicated a marked improvement in the dog's well-being.

This case illustrates that ultrasound- and CT-guided trigeminal neurolysis can be a safe, effective palliative option for managing intractable oncologic pain in dogs. No immediate complications were observed. Targeted neurolytic techniques may represent a valuable strategy to improve quality of life in canine patients with refractory pain.

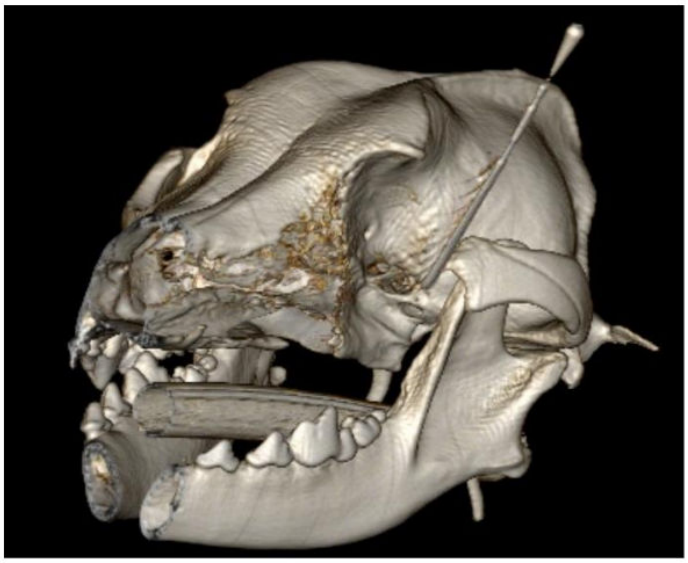

Figure: 3D reconstruction of the trigeminal neurolysis


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4818

# Intraoperative Complications In Anaesthetised Horses: A Comprehensive Prospective Study

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CEPEF4, the fourth phase of the Confidential Enquiry into Perioperative Equine Fatalities, represents the largest current investigation into perioperative fatality risk in horses.

This prospective multicentre cohort study collected data from 47,396 equine anaesthetic procedures, focusing on intraoperative monitoring practices, major complication rates, and emergency drug use. Complication rates were calculated for animals monitored with appropriate devices: arterial pressure for hypotension, pulse oximetry or blood gas analysis for hypoxaemia, capnography for hypercapnia, electrocardiography for arrhythmias, and thermometry for hypothermia. Awakening, bleeding, excitation, and difficult intubation were assessed across the entire cohort. Univariable logistic models evaluated complication risks by ASA grade (ASA I as reference; significance $p < 0.05$). Emergency administration of drugs, including atropine, adrenaline, ephedrine, dobutamine, phenylephrine, noradrenaline, colloids, hypertonic saline, and blood transfusions, was recorded. Blood pressure was monitored in 34,227 procedures, detecting hypotension in 12,402 cases (36.4%). Capnography identified hypercapnia in 1,699 out of 31,102 cases (5.5%). Oxygenation monitoring detected hypoxaemia in 1,648 out of 25,861 cases (6.4%). ECG-monitored horses experienced arrhythmias in 885 out of 42,118 procedures (2.1%). Hypothermia occurred in 579 out of 28,944 monitored cases (2.0%). Awakening complications affected 5,477 procedures (11.6%), whereas bleeding, excitation, and difficult intubation occurred rarely (< 1% each). Complication risks consistently increased with higher ASA grades.

Emergency drugs were administered during 4,613 anaesthetics (9.7%). Dobutamine comprised two-thirds of the interventions, with usage increasing progressively from 63% (ASA I) to 84% (ASA V). Colloids (3.5%) and hypertonic saline (3.8%) were the next most frequent interventions, primarily given to higher-risk horses. Other vasopressors and atropine were rarely used (< 3% each), and transfusions were infrequent (< 0.1%).

Despite widespread monitoring and cardiovascular support, intraoperative complications—especially hypotension—remain common, and their likelihood increases with ASA grade. These findings highlight the necessity for vigilant haemodynamic monitoring and prompt intervention in equine anaesthesia.

4834

# Concordance between rectal temperature and a core temperature measuring device with Zero Heat Flux technology in guinea pigs (Cavia porcellus) anesthetized with isoflurane: preliminary results

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Hypothermia is frequently observed during anesthesia in small mammals. Zero heat flux (ZHF) technology is considered a noninvasive, accurate, precise method to assess core temperature in humans and presented concordance with measurements in the pulmonary artery in pigs (Guschlbauer et al. 2016). This study aimed to determine the agreement between rectal temperature and ZHF thermometry in anesthetized guinea pigs (Cavia porcellus).

A total of 14 adult female Hartley guinea pigs weighing 897 ± 154 g (mean ± SD) were used. Anesthesia was induced and maintained via a face mask connected to a non-rebreathing circuit using 5% and 2% isoflurane in 100% oxygen, respectively. After hair clipping, the ZHF monitor sensor (SpotOn®, Bair Hugger®, 3M, USA) was placed in the midline, at the level of the sternum, and the temperature probe of a multiparametric monitor (Contec® CMS8000, China) was inserted into the rectus approximately 6 cm (TR). Temperature was recorded by both methods every 2 minutes over 24 minutes. The agreement between the paired measurements was studied using the Bland-Altman method corrected for repeated measures, and the 95% confidence intervals (95% CI) of the limits of agreement (LoA) were calculated with a bootstrap non-parametric method based on percentiles (Olofsen et al. 2015).

The bias (median of the differences) between both methods was -0.5°C, with the upper LoA (ULoA) at -0.3°C (95% CI = -0.3, -0.2) and the lower LoA (LLoA) at -1.0°C (95% CI = -1.1, -1.0) (Fig.1). Differences between two thermometric techniques are considered clinically acceptable when the bias is within ± 0.2/0.3°C and LoA are within ± 0.5°C/0.6°C from the bias (Olasinde et al. 2020).

Therefore, the results obtained are close to what could be considered clinically acceptable, highlighting the narrow 95% CI of the LoA.

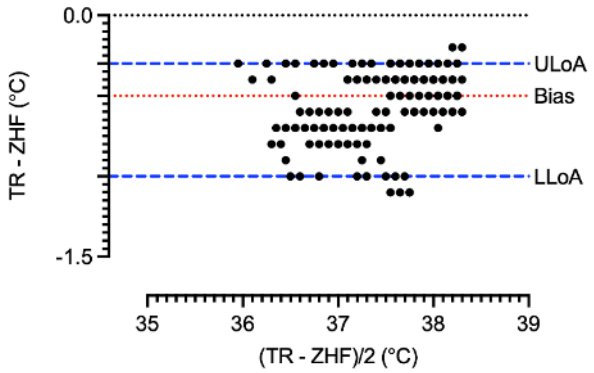


Figure 1. Bland-Altman plot comparing rectal (TR) and zero-heat-flow (ZHF) temperature measurements.

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4848

# Minimum effective sedation dose of dexmedetomidine at GV20adj for radiographic examinations in cats.

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This study aimed to determine the minimum effective dose of dexmedetomidine, administered subcutaneously adjacent to the GV20 acupuncture point (SC-GV20adj), for feline radiographic examinations.

Eight adult cats (4 MC, 3 F, 1 FS; 4.44 ± 1 kg) were enrolled in a prospective, randomized, blinded, crossover study. Each cat underwent three sedation episodes with SC dexmedetomidine at the GV20adj point (5, 10, 20 µg $kg^{-1}$; L, M, H groups). Sedation was scored using a modified 16-point Numerical Rating Scale. Sedation onset (SO) and level of sedation were assessed every 5 minutes, and suitability for three different radiographic views was determined. Radiographs began at 15 minutes, with monitoring extended to 30 minutes if sedation was insufficient. Sedation was reversed with atipamezole (100 µg $kg^{-1}$ SC-GV20adj). Adverse events were recorded. Data were analyzed using two-way ANOVA and linear mixed models ($p < 0.05$).

Twenty-four sedation episodes (n = 8 cats, n = 3 each) were assessed. Adequate sedation to complete radiographic examinations occurred in 50% of cases (100%, 38%, 13% for H, M, L groups; $p = 0.0021$). Mean sedation onset were 11 ± 6, 15 ± 9, and 24 ± 9 minutes (H, M, L, respectively; H vs. L: $p = 0.0020$). NRS scores at onset were 12 (10–15), 12 (5–13), and 6 (4–13) (H, M, L, respectively; H vs. L: $p = 0.0400$). Vomiting occurred in 16 of 24 episodes. Previous studies using the SC-GV20adj route combined 10 µg $kg^{-1}$ with methadone (Solash et al. 2025) or butorphanol (Leclerc et al. 2023), may explain the low suitability (38%) with 10 µg $kg^{-1}$ of dexmedetomidine alone in our study. While 5 µg $kg^{-1}$ was insufficient, 20 µg $kg^{-1}$ provided reliable, profound sedation.

Thus, the minimum effective dose via SC-GV20adj for radiological examinations in cats was 20 µg $kg^{-1}$.

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4854

# Pharmacokinetics and tolerability of liposomal synthetic cannabidiol subcutaneous depot in six Holstein calves

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In horses, cannabidiol (CBD) was reported to provide analgesia, however, first-pass liver metabolism results in low oral bioavailability. Liposomal encapsulation of CBD facilitates slow-drug-release, providing long-term plasma concentrations with consistent effects. Analgesia of CBD was not reported in bovines.

Study goals were to provide preliminary pharmacokinetics and tolerability of a single SC injection of liposomal-synthetic-CBD (L-sCBD; 50 mg $mL^{-1}$; 5 mg $kg^{-1}$) in six Holstein calves (age 8-16 days; body weight 42.7-52.8 kg). Blood was sampled for CBD and metabolites plasma concentrations (baseline, 2, 6, 24, 48, 96-hours, and then weekly up to 6-weeks), complete blood count (baseline, 2-days, 1 and 4-weeks) and serum chemistry (baseline, 1 and 4-weeks). Physiologic parameters and adverse effects were monitored. Data overtime was compared with baseline using linear-regression mixed-effects ($p$-value < 0.05).

Plasma CBD concentrations were measurable for 3-6 weeks; median (range) peak plasma concentration (Cmax) was 44.1 (33.0-48.0) ng mL-1, time to Cmax was 1 (0.25-1) day, half-life was 5.3 (3.8-11.6) days and mean residence time (MRT) was 5.4 (4.0-8.7) days. The primary metabolite was 7-carboxy-CBD, which exceeded CBD exposure; the area under the concentration-time curve (AUC) ratio of 7-carboxy-CBD:CBD was 9.0 (4.2-16.1). A short-term significant increase in neutrophils was observed 2-days after injection. Several chemistry parameters changed from baseline but were clinically insignificant. The main adverse reaction was a local swelling, cytologically characterized as a sterile granulomatous inflammation, which spontaneously resolved within 2-weeks.

In conclusion, L-sCBD administered SC produced detectable CBD plasma concentrations for several weeks and was well tolerated by calves. Evaluation of L-sCBD as an additional long-term analgesic in calves undergoing routine painful agricultural management procedures (e.g., disbudding) is therefore of interest, as long as there is no concern for human exposure.

4855

# Fentanyl concentrations in plasma and colostrum of pregnant dogs following a single intravenous administration

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Premedication with opioids prior to caesarean section in dogs is desirable for analgesia, but pharmacokinetic data in pregnant bitches are limited (Navarro-Altuna et al., 2025). The study aims at exploring plasma and colostrum concentrations of the short-acting opioid fentanyl after IV administration.

Ethics committee approval was granted (Dnr 5.8.18 12021/2023). Animal owners provided written informed consent. Sixteen bitches undergoing caesarean section were premedicated with fentanyl 4 µg $kg^{-1}$ IV over two minutes before induction with alfaxalone and maintenance with sevoflurane. Blood samples were collected immediately after fentanyl (T0) and after 2,5,10,15,20,25,30 and 35 minutes from a dedicated sampling catheter. Colostrum samples were collected once at the end of surgery (93 ± 33 minutes after T0) from 14 bitches. Fentanyl concentrations were quantified using ultra-performance liquid chromatography coupled with tandem mass spectrometry (UPLC-MS/MS). Data were summarised using descriptive statistics (mean ± SD).

The plasma concentration of fentanyl were 6.2 ± 3.6 ng $mL^{-1}$ (T0), 1.5 ± 1.0 ng $mL^{-1}$ (T2), 1.1 ± 0.3 ng $mL^{-1}$ (T5), 0.6 ± 0.2 ng $mL^{-1}$ (T10), 0.4 ± 0.2 ng $mL^{-1}$ (T15), 0.3 ± 0.1 ng $mL^{-1}$ (T20) and 0.3 ± 0.0 ng $mL^{-1}$ (T25,T30 and T35). The concentration measured in colostrum was 3.5 ± 1.1 ng $mL^{-1}$.

The plasma concentration-time course of fentanyl indicates rapid distribution and elimination in anaesthetised pregnant bitches. At T5, plasma concentrations were equivalent to the lower range of the minimum effective plasma concentration for analgesia, while at T10, plasma concentrations were lower than the concentrations indicating provision of analgesia (0.95-2.00 ng $mL^{-1}$) (Sano et al., 2006). The fentanyl concentration in colostrum might indicate accumulation or slower elimination compared to plasma. Considering potential oral or transmucosal absorption (Schmiedt et al., 2007), further studies are warranted to evaluate possible adverse effects on puppies.

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4857

# Sedative effects of continuous-rate infusion of medetomidine with vatinoxan in Thoroughbred horses

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Vatinoxan (VTX) is an α2 adrenoceptor antagonist that doesn't cross the blood–brain barrier, thus reducing the adverse effects of α2 agonists. The sedative and adverse effects of VTX with medetomidine (MED) were examined in Thoroughbred horses.

This was a blinded crossover study of three groups (gM: MED alone; gMA: MED + atipamezole (ATIP); gMV: MED + VTX) of six Thoroughbred horses. Continuous rate infusion (CRI) lasted 60 minutes after IV loading infusion, followed by a 60-minute observation. The following loading doses and CRI rates were used: for MED, 7.0 μg kg–1 and 5.0 μg kg–1 hour–1, respectively, in all three groups; for gMA, 140 μg kg–1 and 100 μg kg–1 hour–1 of ATIP were added; and for gMV, 140 μg kg–1 and 100 μg kg–1 hour–1 of VATX were added. Stimulus response score, ataxia score, head height, HR, fr, borborygmi score, and defecation frequency were recorded. Continuous and categorical variables were compared by using two-way ANOVA and Friedman's test, respectively.

Stimulus response score was significantly higher in gMA than gM, with no significant difference between gM and gMV. Ataxia score and head height showed similar trends. HR and fr were not significantly different among groups. Second-degree atrioventricular block was observed in 5 (gM), 6 (gMA), and 1 (gMV) horses. Borborygmi scores were significantly higher in gMV than gM, and defecation occurred only in gMV (2.3 ± 1.1 times). Therefore, ATIP had limited antiarrhythmic and gastroprokinetic effects, and it reduced the sedative effect of MED. In contrast, VTX effectively suppressed these reactions while maintaining the sedative effect.

CombiningVTX with MED should provide safe sedation in Thoroughbred horses by reducing the peripheral adverse effects of the α2 agonist.

4859

# Sedative effects of detomidine alone and combined with ketamine compared to xylazine in calves undergoing cautery disbudding

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Detomidine, a potent $\alpha_2$-adrenoceptor agonist, is permitted for use in cattle under European legislation. However, its efficacy in calves for cautery disbudding remains poorly understood. This study compared the sedative effects of detomidine alone, detomidine with ketamine, and xylazine in calves undergoing cautery disbudding.

Thirty-nine calves (24 ± 10 days old, 71 ± 16 kg) were equally and randomly assigned to receive IM detomidine 0.05 mg $kg^{-1}$ (D), detomidine 0.03 mg $kg^{-1}$ + ketamine 2 mg $kg^{-1}$ (DK), or xylazine 0.2 mg $kg^{-1}$ (X). Ten minutes later, all calves received SC bilateral cornual nerve blocks (4.5 mg $kg^{-1}$ procaine-epinephrine) and meloxicam (0.5 mg $kg^{-1}$, SC). Cautery disbudding was performed 20 minutes post-sedation. Sedation depth was scored using a 19-point scale (Hokkanen et al. 2014), and reaction to disbudding on a 4-point scale (Adam et al. 2025). Latencies to recumbency, head lift and standing were recorded. Group comparisons used the Kruskal-Wallis test with Bonferroni correction (significance $p < 0.05$).

Recumbency times (2.2 ± 1.01, 2.1 ± 0.64 and 2.2 ± 1.1 min for DK, D, and X) did not differ significantly ($p = 0.796$). Head lift times were significantly shorter in DK than D (35.0 ± 11.8 vs. 54.6 ± 21.0 min, $p = 0.035$). Standing times (63.2 ± 30.3, 67.4 ± 22.6, and 77.9 ± 33.4 minutes for DK, D, and X, respectively) did not differ significantly ($p = 0.210$). Disbudding reaction scores were comparable ($p = 0.409$). Sedation scores did not differ significantly except at 90 minutes, where D showed deeper sedation than DK ($p = 0.043$).

Detomidine, alone or with ketamine, provided effective sedation for cautery disbudding and may offer a suitable alternative to xylazine in calves.

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4860

# Pharmacodynamics of subcutaneous hydromorphone administration in bearded dragons (Pogona vitticeps)

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Thermal threshold (TT) testing has been validated and used for testing opioid efficacy in bearded dragons (Pogona vitticeps) (Sladky et al. 2008, Couture et al. 2017, Hawkins et al. 2019). This randomized, blinded, crossover study investigated TT changes after subcutaneous hydromorphone administration in this species.

A sample of six healthy adult bearded dragons was enrolled after obtaining informed owner consent. The TT testing was conducted using a ramped stimulus (2°C/second) applied to the inner thigh until a response (leg kick, escape, attention to device) was observed or a maximum cut-off temperature (60°C) was reached. Cold thermal latency (CTL) was tested by applying a 0°C probe until a behavioral response was elicited or the cut-off time (60 seconds) was reached. A minimum 20-minute interval between tests reduced habituation and skin irritation. Hydromorphone (0.5 mg kg–1) or an equal volume of saline was randomly administered subcutaneously axillary off midline. The TT and CTL were determined at 0, 2, 4, 8, 12, and 24 hours after injection by a single evaluator. The procedure was repeated four weeks later with the alternative treatment. Data were analyzed using mixed-effect models on ranks. Repeatability and test-retest reliability were measured using the coefficient of variation (CV) and Spearman's rho. Significance was set at $p < 0.05$.

Hydromorphone significantly increased TT compared to placebo at all time points ($p \leq 0.002$) with good repeatability (CV 28.53%). The highest median (interquartile range) TT of 60 (60, 60) °C was recorded two and four hours after injection. Animals recorded overall longer CTL after hydromorphone administration than saline ($p < 0.001$), regardless of time ($p = 0.26$). TT and CTL showed low test-retest reliability (Spearman rho = 0.21 and 0.38, respectively). No skin damage was observed.

Hydromorphone can provide analgesia in bearded dragons for 24 hours.

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4952

# Effects of medetomidine or medetomidine-vatinoxan combined with fentanyl on propofol induction dose and mean arterial pressure in dogs anesthetized with isoflurane

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The aim of the study was to evaluate the selected cardiorespiratory variables and the propofol-sparing effect of medetomidine-fentanyl (MF) vs. medetomidine-vatinoxan-fentanyl (MVF) in isoflurane-anesthetized dogs.

A total of 80 dogs, ASA status I or II, aged 2 – 10 years, weighing 5 – 20 kg were included in this prospective blind randomized clinical study. For premedication, the dogs in the MF group (n = 40) received medetomidine 0.005 mg $kg^{-1}$, the dogs in the MVF group (n = 40) received medetomidine (0.005 mg $kg^{-1}$) and vatinoxan (0.1 mg $kg^{-1}$). In dogs of both groups, fentanyl 0.01 mg $kg^{-1}$ intravenously followed by an infusion 0.01 mg $kg^{-1}$ $hour^{-1}$ was administered. Anesthesia was induced with propofol and maintained with isoflurane in oxygen-air. After induction (T0) and at ten minute intervals for 60 minutes (T10 – T60) HR, MAP, SpO2, $f_R$, $Pe'CO_2$, esophageal temperature and dose of propofol for induction were recorded. The data were analyzed using Shapiro-Wilk and ANOVA tests ($p < 0.05$).

Dogs given MVF required a lower dose of propofol for induction (1.4 ± 0.7 mg $kg^{-1}$) compared to MF group (1.8 ± 0.7 mg $kg^{-1}$, $p = 0.023$). At T0, HR was significantly higher in MVF group (80 ± 21 beats $minute^{-1}$) compared to MF group (60 ± 21 beats $minute^{-1}$, $p = 0.025$). Dogs of MVF group had significantly lower MAP throughout the observation period with a higher incidence of hypotension (MAP < 60 mmHg; 52%) compared to MF group (7%, $p < 0.001$). At time T0 – T40 in MVF group, esophageal temperature was significantly lower. No other significant differences between groups were detected.

Premedication with medetomidine-vatinoxan-fentanyl provided a greater propofol-sparing effect compared to medetomidine-fentanyl. Combination of medetomidine-vatinoxan-fentanyl with isoflurane should be used with caution due to the high incidence of hypotension.

The study was supported by the Ministry of Education, Youth and Sports of the Czech Republic (Research Project IGA VETUNI No. 101/2025/FVL)

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# Incidence of bradycardia, hypotension, or bradycardia with hypotension in dogs undergoing fentanyl-propofol isoflurane or sufentanil-propofol-isoflurane anesthesia

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The aim of the study was to determine the incidence of bradycardia, hypotension, and bradycardia with hypotension in dogs undergoing general anesthesia provided by fentanyl-propofol-isoflurane or sufentanil-propofol-isoflurane.

A retrospective study was performed using anesthetic records from 130 dogs weighing 5 - 30 kg, aged 1 - 10 years undergoing general anesthesia. None of the dogs had bradycardia or hypotension before the anesthesia. For premedication, the dogs in the FEN-group (n = 65) received fentanyl 0.01 mg $kg^{-1}$ intravenously followed by an infusion 0.01 mg $kg^{-1}$ $hour^{-1}$ and the dogs in the SUF-group (n = 65) received sufentanil 0.001 mg $kg^{-1}$ intravenously followed by an infusion 0.001 mg $kg^{-1}$ $hour^{-1}$. Anesthesia was induced with propofol and maintained with isoflurane in oxygen-air, dogs were mechanically ventilated. After induction and at 10 minute intervals for 60 minutes HR, MAP (oscillometric method), $SpO_2$, $f_R$, $Pe'CO_2$, temperature, dose of propofol for induction and FeIso were recorded. Bradycardia was defined as HR < 60 beats $min^{-1}$, hypotension as MAP < 60 mmHg. The data were analyzed using Pearson's chi-square test, Shapiro-Wilk and ANOVA test ($p < 0.05$).

We did not detect a significant difference in the dose of propofol for induction or FeIso for maintenance of anesthesia between the groups. In FEN-group 7 dogs (10.7%) developed bradycardia, 34 dogs (52.3%) hypotension, and 1 dog (1.5%) bradycardia with hypotension. In SUF-group 12 dogs (18.4%) developed bradycardia, 21 dogs (32.3%) hypotension, and 4 dogs (6.1%) bradycardia with hypotension. The incidence of bradycardia was not significantly different between groups. The incidence of hypotension was significantly higher in the FEN-group ($p < 0.010$) compared to the SUF-group.

Bradycardia occurs in dogs under general anesthesia using both fentanyl-propofol-isoflurane and sufentanil-propofol-isoflurane combinations. At the dosages used, the incidence of hypotension was higher in dogs receiving the combination of fentanyl-propofol-isoflurane, requiring caution.

4966

# Association between surgical duration, intraoperative hypothermia, and recovery quality in equine anaesthesia

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Peri-anaesthetic hypothermia is a well-recognised complication in small animal anaesthesia, associated with altered drug metabolism, delayed recovery, and increased morbidity. In equine anaesthesia, hypothermia remains an underreported issue.

This retrospective analysis included 1,020 equine general anaesthesia cases recorded at our teaching hospital. Rectal temperature was measured during the anaesthetic period and recovery. Data, extracted from the anaesthesia records, included patient demographics, clinical parameters, anaesthetic protocols, and intraoperative monitoring values. Hypothermia was defined as rectal temperature of <5°C for 15 minutes. Statistical analyses were performed to identify potential factors associated with the development of hypothermia, using Mann-Whitney U for continuous and Chi-Square tests for categorical data. Logistic regression was used to analyse the interactions.

Out of all cases, 110 horses (10.8%) experienced hypothermia. Cases with hypothermia had significantly longer mean surgery times (109 minutes) compared to non-hypothermia cases (75 minutes, $p = 0.000031$), worse recovery scores (median 2 vs. 1, $p = 0.0012$), longer recovery times (mean 61 vs. 46 minutes, $p = 0.000064$), and higher ASA score (3 vs. 2, $p = 0.001$). A significantly higher number of horses in the hypothermia group were anaesthetised for colic surgery (44.5% vs. 21.9%, $p = 0.00003$). Hypothermic horses were also more likely to suffer from hypotension, hypercapnia and hypoxaemia. When accounting for surgery duration, the independent effects of hypoxaemia and premedication with acepromazine on hypothermia were not significant, but hypotension and hypercapnia remained important risk factors. However, the retrospective nature of this study precluded us from determining the independent role of hypothermia on recovery length and quality.

These results show that surgery duration is the strongest continuous predictor of intraoperative hypothermia, and that hypothermia is related to recoveries of longer duration and poorer quality.

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# Evaluation of firocoxib and pregabalin for the management of oncologic pain in dogs with oral neoplasms

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It is estimated that 43% of canine patients experience oncologic pain. Oral cavity tumors present unique anatomical and pathological characteristics with significant challenges for clinical management (Fan et al. 2014).

The objective of this study was to assess the efficacy of firocoxib and pregabalin in managing oncologic pain in canine patients with oral tumors, in a prospective, randomized, double-blinded, positively controlled trial. Patients (n = 20) were assigned to two groups: control group received firocoxib at 5 mg/kg once daily and a placebo capsule twice daily, while the treatment group received firocoxib at the same dose plus pregabalin at 4 mg/kg BID, for 21 days. Rescue analgesia with dipyrone (25 mg/kg) was permitted. Pain assessments were conducted on days 0, 7, 14, and 21. Caregivers used two validated scales: the Composite Oral and Maxillofacial Pain Scale (COPS-C/F) and the Canine Owner-Reported Quality of Life Questionnaire (CORQ) (Della Roca et al., 2019). The COPS-C/F also included a specific section for veterinary assessment. Blood samples were collected on days 0 and 21 for complete blood count and renal and hepatic function analysis.

Two dogs were euthanized before completing the study due to rapid disease progression. Statistical analysis using the Kruskal-Wallis test revealed no significant differences over time between groups for COPS-C/F caregiver assessments (control: $p = 0.14$; treatment: $p = 0.11$), COPS-C/F veterinary assessments (control: $p = 0.29$; treatment: $p = 0.26$), or CORQ scores (control: $p = 0.15$; treatment: $p = 0.37$). Treatment group exhibited a clinically relevant reduction of more than 30% in COPS-C/F pain scores (Farrar et al., 2001).

Although these findings were not statistically significant, a 30% decrease in pain scores suggests that the combination of firocoxib and pregabalin may be an option for managing cranial cancer pain in canine patients.

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4975

# Perianesthetic analgesia management of brazilian anesthesists

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This is the first survey conducted on veterinarians perianesthetic analgesia practices in Brazil.

A questionnaire (CEP/UFRPE No. 4.670.086) containing 34 questions about analgesic and anesthetic management in dogs and cats was applied, with three biases considered: gender, region of practice (Southeast, Central-West, North, South, and Northeast), and length of professional experience (up to 5 years; between 6 and 10 years; up to 15 years; over 15 years of experience). Descriptive statistics were used for each question, followed by the Chi-square test or Fisher's exact test ($p < 0.05$) to verify associations between qualitative variables.

The response rate was 80% (418 out of 471 professionals completed all questions), and the participants were self-selected. There was a statistical difference among professionals from different regions regarding the use of meloxicam and dipyrone in the postoperative period, indicating higher usage in the Southeast and South compared to the North. Locoregional blocks (LRBs) use is more common among professionals who pursued academic enhancement, and the drugs mainly used for this purpose were lidocaine, bupivacaine, and morphine. Male specialists are more likely prone to use ultrasound. Regarding transanesthetic analgesia, CRIs with ketamine and dexmedetomidine are more frequently used by men. Postoperative pain assessments by more recently graduated professionals are based on clinical experience, and those without advanced training are more likely to neglect this assessment.

The study indicated that perianesthetic analgesia is satisfactory, as there is significant use of LRBs and equipment that enhances the procedure's effectiveness, along with CRI and postoperative medications.

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4977

# A randomised, blinded, prospective clinical trial comparing sedation scores in dogs following methadone and medetomidine administration at different sites: Intramuscular epaxial lumbar, intramuscular quadriceps, or subcutaneous Governing Vessel-20

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Subcutaneous injection is less painful than intramuscular injection (Gurney et al. 2009) but can have a less predictable effect and slower onset. However, subcutaneous injection of sedatives and analgesics at the Governing Vessel-20 (GV-20) may result in improved sedation and analgesia (Pons et al. 2017, Scallan et al. 2021).

Seventy-five dogs were premedicated with 5 mg $m^{-2}$ methadone and 500 µg $m^{-2}$ medetomidine. Route of administration was determined by random allocation: SC at GV20, IM quadriceps (IM-Q), or IM epaxial lumbar (IM-L) and sample size calculation indicated 25 dogs per group. Sedation was scored at 3-, 7- and 10-minutes post injection using a simple descriptive scale. The Kruskal-Wallis H test was used to determine any significant difference in sedation scores between groups. Post hoc pairwise comparison was carried out for significant results using a Dunn's test with Bonferroni correction.

Median sedation scores were 7 (2 – 15) for GV20 (n = 33), 8.5 (1 – 13) for IM-Q (n = 21) and 4 (0 - 13) for IM-L (n = 21) at 3 minutes; 13 (7 – 18) for GV-20, 15 (4 – 19) for IM-Q, and 11 (0 – 17) for IM-L at 7 minutes; and 16 (4 – 19) for GV-20, 16 (9 – 19) for IM-Q, and 13 (0 – 18) for IM-L at 10 minutes. Scores were different between IM-L and IM-Q ($p = 0.009$) at 3 minutes, IM-L and IM-Q ($p = 0.008$) and IM-L and GV-20 ($p = 0.013$) at 7 minutes, and GV-20 and IM-L ($p = 0.028$) at 10 minutes. Scores were similar between GV-20 and IM-Q. There was no difference in response to injection between groups ($p = 0.207$).

Sedation is more reliable following administration of methadone and medetomidine into the quadriceps compared with the lumbar muscles. Subcutaneous injection at GV-20 is a well-tolerated alternative to intramuscular sedation.

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4978

# Volatile agent capture in dogs and cats following medetomidine-methadone-ketamine-isoflurane anaesthesia

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Isoflurane remains indispensable for the induction and maintenance of anaesthesia, however, its contribution towards climate change has been recognised (Romanello et al. 2023). Volatile capture is an emerging technology in human anaesthesia (Gandhi et al. 2024). One veterinary study identified an isoflurane capture efficiency of 65% using activated carbon (White et al. 2025).

During a prospective observational study, we evaluated the efficiency of a veterinary capture device for isoflurane (VET-can, SageTech Veterinary) in anaesthetised cats and dogs. Purposeful sampling at a charity practice was used to recruit enough animals undergoing general anaesthesia with isoflurane to fill one VET-can to capacity. The VET-can was positioned downstream of the anaesthetic breathing system (Circle system or Ayre's T piece with Jackson Rees modification) within the passive scavenging system. The vaporiser and VET-can were weighed pre- and post-anaesthesia to determine in vivo mass transfer (MT) of isoflurane and water. All animals were anaesthetised with medetomidine, methadone and ketamine and maintained with isoflurane in oxygen. Animals were continuously monitored with pulse oximetry, non-invasive blood pressure, capnography and agent end-tidal concentrations. At the end of the procedure, the vaporiser was turned off and the time recorded until FI'ISO and FE'ISO measured 0%. The primary outcome was capturing efficiency (isoflurane delivered: desorbed, %). The secondary outcomes were correlations (Spearman) between MT and patient characteristics and anaesthesia variables.

Thirty anaesthetics (21 cats, 9 dogs) over 1,705 minutes were required to fill the VET-can. There was an overall capture efficiency of 81% isoflurane and 4% water. The median MT including 4% water was 86% (57 – 101%). There were no significant relationships of MT with anaesthesia variables or patient characteristics.

The capture device prevented a mean release of 3.2 kgCO2e for each 20-minute anaesthetic period. The Vet-can technology is a promising carbon mitigation strategy and promises facilitation of isoflurane reuse.

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5009

# Enhanced post-capture activity in urban red foxes (Vulpes vulpes) following alfaxalone-midazolam versus medetomidine-midazolam immobilisation: preliminary findings.

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Medetomidine-midazolam (MM) is a recommended combination for immobilising wild foxes (Shilo et al., 2010). However, even when a2-adrenoceptor agonist-induced sedation is reversed with an antagonist, rebound sedation can occur (Ranheim 1999; Vainio & Vähä-Vahe 1990), leading to prolonged and potentially unsafe recovery in wildlife.

This prospective, blinded, randomised clinical trial compared MM with an alfaxalone-midazolam (AM) combination. Our hypothesis was that AM would result in higher post-capture activity levels within the first 24 hours. Fifteen urban red foxes (Vulpes vulpes) were captured: seven received MM (medetomidine 0.07 mg $kg^{-1}$ + midazolam 0.8 mg $kg^{-1}$ intramuscularly, IM) and eight received AM (alfaxalone 3 mg $kg^{-1}$ + midazolam 0.8 mg $kg^{-1}$ IM). Each fox was fitted with a GPS collar equipped with Very High Frequency (VHF) and accelerometery units. Sedation was reversed with atipamezole (0.35 mg $kg^{-1}$ IM) for MM and flumazenil (0.01 mg kg-1 IM) for AM.

Activity during the 24-hour post-immobilisation period was evaluated using Vectorial Dynamic Body Acceleration (VeDBA) as a proxy for energy expenditure. Five datasets from 4 foxes (AM n = 3; MM n = 2; one fox acting as its own control) are included in these results. Preliminary accelerometery data shows higher activity levels in AM-treated foxes compared to those receiving MM. Early results, analysed via linear regression, show significantly higher VeDBA values in the AM group (Figure 1) after the initial release-related activity burst ($p < 0.001$). Further segmented regression analysis is underway.

These preliminary findings suggest that the AM protocol may result in higher post-reversal activity levels in foxes during the 24-hour following immobilisation.

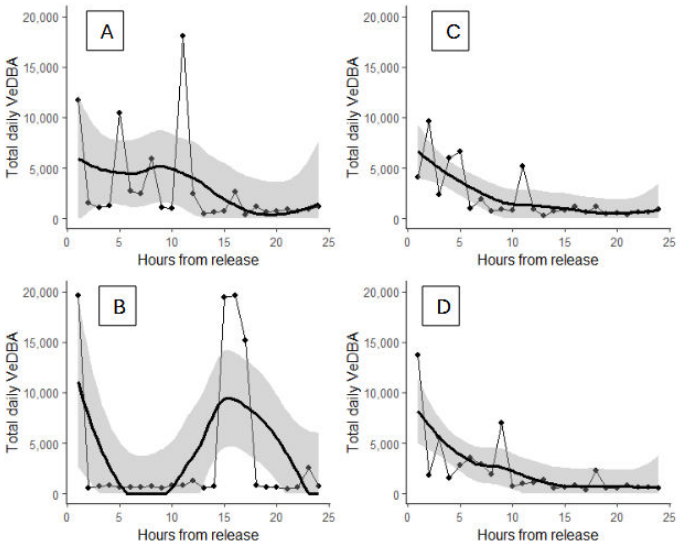


Figure 1. Daily activity levels (VeDBA) of four red foxes following reversal of immobilisation using two sedation protocols: AM (A, B) and MM (C, D).

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5013

# A pilot study evaluating capture of three volatile agents from anaesthetised horses

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The volatile agents are recognised as contributing to climate change with desflurane having the greatest impact (Haseler et al 2023). Capturing volatile agents is well-understood but full environmental and economic cost is unclear.

We evaluated the *in vivo* Mass Transfer of a capture device (VET-can, SageTech Veterinary, UK) in anaesthetised horses using isoflurane, sevoflurane and desflurane. Purposeful sampling at one UK equine hospital was used to recruit enough horses to fill two Vet-cans. The VET-can was positioned downstream of the anaesthetic breathing system (Bird Mark 7, JDMedical Phoenix USA) before the active gas scavenging system. *In vivo* mass transfer (MT %) was calculated by weighing the VET-can and vaporiser before and after each anaesthetic. Anaesthesia was induced with ketamine and midazolam following acepromazine, morphine and romifidine. Horses received isoflurane (n=12) or sevoflurane (n=5) or desflurane (n=1) for maintenance of anaesthesia. Horse's lungs were ventilated to normocapnia and horses received dobutamine to maintain MAP> 60mmHg. All horses received intraoperative romifidine (40 µg $kg^{-1}$ $hour^{-1}$) and intravenous fluid therapy. Volatile hygiene measures were employed (leak checking, cuff inflation), and the breathing system was capped and flushed at the end of the procedure and residual volatile % recorded. Appropriate parametric or nonparametric statistical analyses were used.

Eighteen horses were required to fill 2 cans. Vet-can capacity and the order of groups limited desflurane group size. There were no significant differences in patient characteristics, the dose of dobutamine, cardiopulmonary variables, MAC multiples, MAC hours or recovery quality. The median *in vivo* MT differed between groups ($p = 0.035$); 34% (22-54) for isoflurane, 48% (38-54) for sevoflurane and 80% (0) for desflurane.

Future studies evaluating wash out kinetics and capture during recovery are indicated, especially for isoflurane to maximise capture. The Vet-an offers exciting possibilities for sustainability advancements.

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5015

# Prospective comparison of recovery after desflurane and isoflurane anaesthesia incorporating a romifidine constant rate infusion in horses

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Serious injury during recovery from anaesthesia is a recognised complication. Coordinated rapid recoveries should reduce the risk. Desflurane's kinetics produce shorter recoveries than isoflurane (Midon et al 2024, Taylor et al 2023).

Isoflurane and desflurane anaesthesia, each incorporating a constant rate infusion (CRI) of romifidine, were compared. One hundred and one horses undergoing elective surgery were recruited prospectively. Anaesthesia was induced with ketamine and midazolam following acepromazine, morphine and romifidine. Horses were randomly assigned to receive isoflurane (I) or desflurane (D) for maintenance of anaesthesia. Horses' lungs were ventilated to normocapnia and haemodynamic support was provided (dobutamine to maintain MAP> 60mmHg). All horses received a romifidine CRI (40mcg kg hour$^{-1}$) and 20 mcg kg$^{-1}$ in recovery. Recovery was unassisted and timed and video-recorded for offline evaluation (quality score 0-5 and number of standing attempts) by two "blinded" experienced clinicians. Appropriate parametric or nonparametric statistical analyses were used.

Group D horses were heavier ($p = 0.0113$), and there were more D male ($p = 0.03$) and dorsally positioned ($p = 0.03$). Averaged MAC multiples were lower in D than I ($P < 0.0001$). When averaged over the entire anaesthetic, MAC hours were similar between groups. Two D horses required additional thiopentone. There were no significant differences (Mann Whitney) in the dose of dobutamine, cardiopulmonary variables or recovery quality. There was substantial agreement between observers for I (kappa = 0.77) and D (kappa = 0.93) respectively. Recovery to standing was faster after D (35 [15-81]) than I (40 [23-92] minutes) ($p < 0.0001$). One D horse was euthanased due to spinal cord malacia.

Haemodynamic support and recovery quality were similar between groups. Desflurane horses stood up sooner; a shorter hazardous recovery "window" should allow less time for disaster however the environmental impact of desflurane must be considered concurrently.

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5040

# The impact of pharmacopuncture with lidocaine on perioperative analgesic requirements and systemic inflammatory response in dogs with pyometra

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This study compared the effects of lidocaine pharmacopuncture and intravenous constant rate infusion (CRI) on perioperative analgesia and interleukin levels in dogs with pyometra undergoing ovariohysterectomy.

Following methadone (0.3 mg $kg^{-1}$ IM) administration, anesthesia was induced with propofol intravenously dosed to effect and maintained with isoflurane. After intubation, 27 dogs were randomly assigned (n = 9 per group) to receive lidocaine (1 mg $kg^{-1}$) at the Stomach 36 and Spleen 6 acupoints (LAP-G), lidocaine CRI (2 mg $kg^{-1}$; 50 µg $kg^{-1}$ $min^{-1}$; LIV-G), or saline CRI (2 mL $kg^{-1}$; 2 mL $kg^{-1}$ $min^{-1}$; SAL-G). Intraoperatively, cardiopulmonary variables and FE´ISO were monitored. Fentanyl (2.5 µg $kg^{-1}$) was given to control cardiovascular responses to surgical stimulation. Pain and sedation scores were assessed preoperatively and up to 24 hours post-extubation. Methadone (0.3 mg $kg^{-1}$ IM) was given as rescue analgesia. If pain persisted, metamizole (25 mg $kg^{-1}$ IM) was administered. Interleukins (IL-6 and IL-10) were measured before and 24 hours after surgery. Data were analyzed using Fisher's exact, Wilcoxon, Kruskal-Wallis, and Friedman tests ($p < 0.05$).

Cardiopulmonary variables, FE´ISO, interleukin levels, pain, and sedation scores did not differ among groups. Analgesic intervention was required in 11% in LAP-G (fentanyl and methadone, n = 1), 56% in LIV-G (fentanyl and methadone, n = 3; methadone, n = 2), and 67% in SAL-G (fentanyl, n = 3; fentanyl and methadone, n = 1; methadone, n = 2), with significant differences only between LAP-G and SAL-G (p = 0.04). Compared to baseline, IL-6 significantly decreased postoperatively in LAP-G (Figure 1).

Lidocaine pharmacopuncture provided similar effects to CRI lidocaine, while reduced analgesic requirements compared to saline CRI and attenuated IL-6 from preoperative levels.

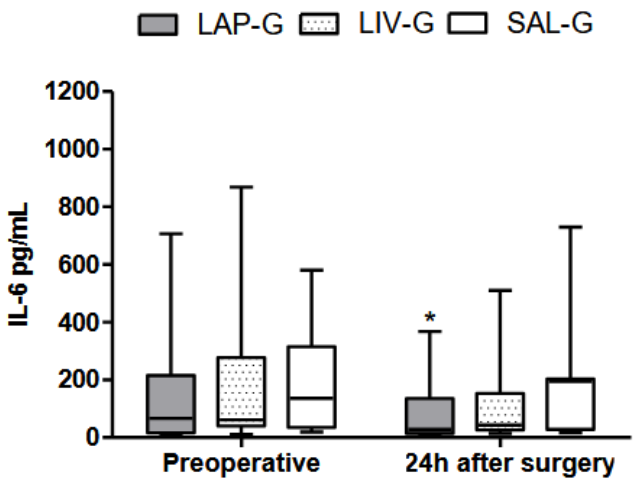


Figure 1. Serum IL-6 concentrations in dogs with pyometra undergoing ovariohysterectomy

*Significantly different from baseline values (Wilcoxon test, $p = 0.031$)

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5041

# Comparison of peribulbar block with neosaxitoxin or bupivacaine on postoperative analgesia in dogs undergoing reconstructive keratoplasty: preliminary results

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Neosaxitoxin is a phycotoxin that has demonstrated long-lasting analgesic effects with minimal risk of systemic and local toxicity (Kohane et al. 2000, Cusick and Sayler 2013). The aim of this study was to compare the postoperative analgesic effects of a peribulbar block with neosaxitoxin or bupivacaine in dogs diagnosed with deep corneal ulcers undergoing reconstructive keratoplasty.

The anesthetic protocol included dexmedetomidine and methadone, propofol and isoflurane. Immediately after intubation, the dogs were randomly assigned to receive a peribulbar block with either neosaxitoxin (3.5 µg diluted in 0.9% saline to a final volume of 0.2 mL kg-1; NeoSTX-G, n = 8) or 0.5% bupivacaine (0.2 mL kg-1; Bupi-G, n = 8). Subjective pain scores, corneal esthesiometry, and blepharospasm were assessed preoperatively and up to 24 hours post-extubation. Methadone (0.3 mg kg-1, IM) was administered as rescue analgesia if the pain scores totaled ≥ 9/21 or any categorical pain score was ≥ 3. The duration of analgesia (time between the peribulbar block and the first dose of rescue analgesia) was also recorded. Data were analyzed using unpaired t test, Fisher's exact test, the Mann-Whitney U test, and the Friedman test ($p < 0.05$).

Corneal esthesiometry, blepharospasm, and pain scores did not differ significantly between groups, except at 24 hours, when lower corneal sensitivity values were observed in the NeoSTX-G [1.5 (1 – 4.5 g mm-2)] compared to the Bupi-G [3 (2 – 4.5 g mm-2)] ($p = 0.02$). Rescue analgesia was required in 57% and 28.5% of the dogs in the Bupi-G and NeoSTX-G, respectively ($p = 0.59$). The duration of analgesia was longer in the NeoSTX-G compared to the Bupi-G (898 ± 202 versus 331 ± 59 minutes, $p = 0.0028$).

These preliminary findings suggest that peribulbar block with neosaxitoxin may be a viable option to prolonging analgesia following canine keratoplasty.

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5046

# Quadratus lumborum block in rabbits (Oryctolagus cuniculus): comparison after lidocaine, bupivacaine or lidocaine-bupivacaine administration.

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Ultrasound-guided quadratus lumborum block (QLB) is considered a safe procedure to generate abdominal analgesia, but information in rabbits is still scarce (Torres et al. 2023). The aim of this study was to determine the duration and caudal distribution of QLB, based on cutaneous dermatome mapping, comparing the administration of lidocaine, bupivacaine and lidocaine-bupivacaine combination.

A prospective, blinded randomized clinical study with a crossover design was conducted in 10 healthy rabbits, after owner consent, scheduled for general anesthesia for other purposes than this study. Each animal received three treatments with a washout time of one month among them. General anesthesia was performed with intravenous propofol and inhaled isoflurane in 100% oxygen. Animals were distributed into three groups: lidocaine 4 mg $kg^{-1}$ (LIDO), bupivacaine 4 mg $kg^{-1}$ (BUPI) and 2 mg $kg^{-1}$ lidocaine + 2 mg $kg^{-1}$ bupivacaine (LIDO-BUPI) using a final volume of 0.3 mL $kg^{-1}$ with Hartmann solution. The needle was introduced in-plane in ventro-dorsal approach under the thoracolumbar fascia of L1 transverse process. Dermatomes were determined by skin clamping technique. Data were evaluated with analysis of variance ($p < 0.05$).

No differences on block onset were observed among groups (10.3 ± 2.1) minutes. Groups BUPI and LIDO-BUPI had higher time to maximum effect (114.7 ± 44.1) and (108.0 ± 31.9) respectively than LIDO (64.2 ± 11.19) minutes. Block duration was shorter in LIDO (175 ± 8.1) than BUPI (321.8 ± 73.5) and LIDO-BUPI (373. 0 ± 57.6) minutes. The more frequent caudal distribution (21/30) was L1 - L5 in all treatments, although L1 - L6 was only observed in LIDO-BUPI (5/10) and BUPI (1/10). The L1 - L4 distribution was achieved only in LIDO (4/10). No signs of toxicity or ataxia were observed. The QLB, in all treatments, at the doses used, produced cutaneous abdominal desensitization in all rabbits.

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5047

# The effect of positive end-expiratory pressure (PEEP) on cardiorespiratory variables in healthy dogs undergoing elective ovariohysterectomy under two ventilation modes: preliminary results

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Positive end-expiratory pressure (PEEP) is often used to improve oxygenation during mechanical ventilation, yet its cardiovascular impact remains a concern.

Eighteen client-owned dogs undergoing elective ovariohysterectomy (dorsal recumbency) were prospectively enrolled in this study. All animals were premedicated with dexmedetomidine (120 μg $m^{-2}$ IM) and tramadol (3 mg $kg^{-1}$ IM). Anaesthesia was induced with propofol to effect and maintained with isoflurane in 100% oxygen. The patients were randomly assigned to volume-controlled (group VCV, n=9) or pressure-controlled (group PCV, n=9) ventilation. A dorsal pedal artery and the pulmonary artery were catheterised. Cardiac output (CO), arterial oxygen content (CaO2) and delivery (DO2) were recorded at three timepoints corresponding to three PEEP levels (cmH2O): t20 (PEEP 0), t40 (PEEP 5), and t60 (PEEP 10), twenty, forty and sixty minutes after the initiation of mechanical ventilation, respectively. Data were analyzed using a general linear model for repeated measurements ($\alpha < 0.05$).

In group PCV, CO and DO2 decreased significantly from t40 to t60 while CaO2 increased significantly from t20 to t60. In VCV CaO2 decreased significantly in t40 and t60 compared to t20 (Table 1).

PEEP at 10 cmH20 in healthy dogs with PCV resulted in a reduction of CO and DO2, though oxygenation was improved.

| | | **t20** | **t40** | **t60** |
|---|---|---|---|---|
| CO | VCV | 1.78 ± 0.44 | 1.84 ± 0.36 | 1.80 ± 0.43 |
| | PCV | 1.68 ± 0.49 | 1.78 ± 0.50[a] | 1.50 ± 0.43[a] |
| $CaO_2$ | VCV | 17.61 ± 2.52[b,c] | 16.70 ± 1.80[b] | 16.38 ± 1.79[c] |
| | PCV | 16.59 ± 2.01[d] | 17.10 ± 2.22 | 17.26 ± 1.91[d] |
| $DO_2$ | VCV | 30.93 ± 5.98 | 30.73 ± 6.19 | 29.14 ± 8.08 |
| | PCV | 28.09 ± 8.5 | 30.75 ± 9.59[e] | 25.71 ± 6.78[e] |

Table 1. Mean ± SD of CO (L/min), CaO2 (mL $O_2$/dL), and DO2 (ml O2/min) in each group and timepoint. Same superscript indicates statistically significant difference in this pairwise comparison.

5048

# Propofol requirements for induction of anesthesia in dogs with cervical or thoracolumbar myelopathy

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This retrospective study aimed to compare propofol requirements for induction of anesthesia in dogs diagnosed with either thoracolumbar or cervical focal myelopathy.

The anesthetic records of dogs with either cervical or thoracolumbar myelopathy anesthetized for diagnostic or surgical procedures from September 2021 to July 2024 were evaluated. Inclusion criteria were premedication with the same dose of dexmedetomidine (180 μg $m^{-2}$), and induction with propofol. The sedation scores and the total propofol dose required for intubation were extracted. Data were analysed with the Mann-Whitney test, the t-test, and the Pearson correlation test. A value of $p < 0.05$ was considered statistically significant.

Sixty anesthetic records were included in the study, 29 dogs with cervical and 31 with thoracolumbar myelopathy. Statistically significantly higher doses of propofol were required in the dogs with cervical (median 3.2 mg $kg^{-1}$, range 1.5 - 7 mg $kg^{-1}$) than with thoracolumbar (1.9 mg $kg^{-1}$, range 1 - 4 mg $kg^{-1}$) myelopathy (Mann-Whitney test, $p < 0.0005$). The sedation score in the dogs with cervical (mean 5.9, SD 1.9) also differed statistically significantly from the sedation score of the dogs with thoracolumbar (mean 7.4, SD 2.8) myelopathy (t-test, $p = 0.02$). Propofol dose and sedation score were significantly negatively correlated (Pearson's correlation coefficient - 0.333, $p = 0.009$).

Our findings suggest that propofol requirements are higher in dogs with cervical compared to those with thoracolumbar focal myelopathy. This should be considered when planning anesthetic protocols in order to optimize safety in these patients.

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5055

# Breed-specific anaesthetic mortality in dogs: Evidence from an analysis of 55,022 cases

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The objective of this study was to evaluate the breed's influence on anaesthetic mortality in dogs.

This multicentric cohort study evaluated 55,022 dogs undergoing anaesthesia, focusing on deaths directly linked to anaesthesia from premedication to 48 hours post-extubation. Dogs that were euthanised or died from medical or surgical complications were excluded. Data were analysed according to breed, Fédération Cynologique Internationale (FCI) groups and sections, MDR1 mutation status, and brachycephalic conformation, with mixed-breed dogs serving as a reference for statistical comparisons using a chi-square test ($p < 0.05$).

The overall anaesthetic mortality rate was 0.69%. In mixed-breed dogs, the mortality rate was 0.68% (deaths/number of cases: 109/16,107). Yorkshire Terriers (29/3,155; 0.9%, p = 0.174), Labrador Retrievers (14/2,727; 0.5%, p = 0.395), French Bulldogs (15/2,619; 0.6%, p = 0.632), Ibizan Hounds (20/2,372; 0.8%, p = 0.437), Poodles (12/1,840; 0.7%, p = 1.000), Golden Retrievers (10/1,477; 0.7%, p = 1.000), Dachshunds (4/1,188; 0.3%, p = 0.224), Maltese (4/1,162; 0.3%, p = 0.242), Boxers (5/1,138; 0.4%, p = 0.444), Beagles (6/1,121; 0.5%, p = 0.709) and English Cocker Spaniels (4/1,095; 0.4%, p = 0.298) showed no significant differences. In contrast, Chihuahuas (16/1,182; 1.4%, p = 0.013) and German Shepherd Dogs (17/1,163; 1.5%, p = 0.004) exhibited significantly higher mortality rates than mixed breeds. Analysis by FCI groups and sections revealed uniform survival rates, except for the Chihuahueno section. Comparisons by MDR1 mutation status (YES: 0.71% vs. NO: 0.70%; p = 1.000) showed no differences. However, brachycephalic breeds had increased mortality rates (YES: 0.82% vs. NO: 0.66%; p = 0.046).

Breed significantly influences anaesthetic mortality in dogs. Chihuahuas, German Shepherds, and brachycephalic dogs have a higher risk than mixed breeds. These findings support the development of breed-specific anaesthetic protocols and highlight the need for further research into the factors driving these differences.

5056

# Current attitudes towards the use of analgesics and painful interventions in small animals by Mexican veterinarians

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The aim of this study was to determine attitudes towards the use of analgesics and painful interventions in small animals by Mexican veterinarians, as no published information on this topic exists in Mexico.

A prospective online survey was distributed (April - December 2022) to associations of veterinary practitioners and organizers of veterinary meetings throughout Mexico. A survey link and QR code were provided. The survey consisted of four sections: 1) demographic data, 2) use of analgesics, 3) attitudes to painful interventions, and 4) continuing education. Descriptive statistics including frequency analysis and Chi-square test ($p < 0.05$) were used.

The survey was opened by 1,827 participants, of whom 280 completed it (15.32% response rate). 50% were women and 50% men. The most commonly used analgesics were nonsteroidal anti-inflammatory drugs (80.7%), steroids (71.6%), opioids (68.3%), local anesthetics (68%), ketamine (67%), and alpha-2 agonists (64%). Fewer than 5% used other analgesics, including gabapentinoids or cannabinoids. The most commonly used opioid was tramadol (68.3%), followed by buprenorphine (49.7%), and pure mu agonists (18%). For surgery-related pain, similar percentages used analgesics pre-operatively (81%) and post-operatively (83%). Veterinarians considered general abdominal surgeries to be painful interventions (40% to 65% participants) and orthopedic surgeries to be very painful (79% to 86%). In contrast, some (1.3% to 3.3%) considered orchiectomy not painful. All veterinarians considered continuing education important, though 27.4% reported difficulties accessing it. Regional workshops (99%) and lectures (87.5%) were the most important sources of knowledge. All participants treated pain, but few used pure mu opioids, even for very painful interventions. Lack of availability and fear of regulations were the most commonly reported barriers.

Continuing education programs are needed to train practitioners in the use of alternative drugs and analgesic techniques for treating painful interventions in Mexico, given the limited access to pure mu opioids.

5062

# Use of adrenaline to facilitate surgical management of nephrosplenic entrapment in anaesthetized horses: A case series

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Surgical management of nephrosplenic entrapment (NSE) in horses is often complicated by splenic enlargement. The use of phenylephrine has been described in medical or surgical treatment of NSE (Abutarbush & Naylor 2005). However, its access for veterinarians is limited in some countries. Adrenaline is a potential alternative but is rarely described (Cherdchutham et al. 2021). This case series documents the use of adrenaline as a slow intravenous injection in 3 horses surgically treated for NSE.

All horses were presented with colic signs, unresponsive to medical treatment. Premedication included dexmedetomidine (3.5 - 5 µg $kg^{-1}$ IV) and morphine (0.1 mg $kg^{-1}$ IV), followed by induction with either midazolam or diazepam (0.05 mg $kg^{-1}$ IV) and ketamine (2.2 mg $kg^{-1}$ IV). Anaesthesia was maintained with sevoflurane delivered in oxygen and air, and dexmedetomidine IV infusion (1 µg $kg^{-1}$ $hour^{-1}$).

Entrapment of the colon over the nephrosplenic ligament was observed with marked enlargement of the spleen, which restricted intestinal manipulation. Therefore, adrenaline was injected slowly over 3 - 5 minutes (10µg $kg^{-1}$ IV in case (2), 2.5 µg $kg^{-1}$ in cases (1,3). This resulted in transient tachycardia and hypertension. Splenic contraction and size reduction were subjectively noted by the surgeon, allowing correction of the entrapment. Horses recovered uneventfully, cases (2,3) were discharged two weeks post-operatively, while case (1) was euthanized after a second laparotomy due to peritonitis and adhesions. Adrenaline was chosen due to the unavailability of phenylephrine. Being a potent vasoconstrictor, hypertension and reduced tissue perfusion were a matter of concern, in addition to tachyarrhythmias and sweating. However, the increase in HR and blood pressure was transient. Additionally, adrenaline is a legal drug for use in food producing animals.

In conclusion adrenaline was well tolerated in horses under general anaesthesia and facilitated surgical treatment of NSE.

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5063

# Interobserver agreement in the classification of anaesthetic deaths in horses: a tie-breaker approach

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The objective of this study was to assess inter-observer agreement in classifying fatalities during equine anaesthesia as either DEATH—an unexpected, unassisted death not attributable to any veterinary decision—or PTS, a planned euthanasia following a veterinary recommendation or the owner's request.In this retrospective, multicentre analysis, 2630 anaesthetised horses from the CEPEF4 database (Gozalo-Marcilla et al. 2025) were used.

Three independent evaluators (A, B, and C) assigned each case to DEATH or PTS. Inter-observer agreement was measured using Light's κ, Fleiss' κ, intraclass correlation coefficient (ICC), and pair-wise Cohen's κ. Records without unanimous agreement were defined as the "non-consensus subset" and reclassified by a fourth evaluator (D) to break ties.

Evaluators A, B, and C labelled 16.0%, 20.1%, and 33.3% of cases, respectively, as DEATH. A complete consensus was reached in 80.3% of the records. Overall agreement was substantial (Light's κ = 0.638; ICC = 0.618; Fleiss' κ = 0.618; all $p < 0.001$). Pairwise agreement was substantial between A and B (κ ≈ 0.81), moderate between A and C (κ ≈ 0.51) and B and C (κ ≈ 0.60). The non-consensus subset comprised 519 records (19.7%). Within this subset, A, B, C, and D classified 6.9%, 26.6%, 91.9%, and 11.4% of cases, respectively, as DEATH. Agreement in this subset was poor (Light's κ = 0.090; $p = 0.649$). Compared with D, agreement remained substantial for A (κ = 0.53; 92.1%), moderate for B (κ = 0.22; 75.1%), and negligible for C (κ = –0.05; 13.3%).While agreement for classifying fatalities as DEATH (no veterinary decision) or PTS (veterinary decision involved) was substantial overall, it deteriorated in nearly one-fifth of cases.

This variability highlights the need for standardised, consensus-based criteria to improve consistency in reporting equine peri-anaesthetic mortality.

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5065

# Delayed motor recovery following propofol induction compared to alfaxalone in a cat with spinal disease

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Both alfaxalone and propofol act as allosteric modulators of the GABAA receptor, although their pharmacological profiles differ slightly (Warne et al. 2015). This case report describes suspicion of delayed recovery of motor function due to induction with propofol in a cat with spinal disease compared with alfaxalone.

The patient was a 10-year-old neutered male cat weighing 5.5 kg, presenting with an intramedullary spinal mass lesion (suspected sarcoma or glioma) at the T13–L1 level. Volumetric arc radiotherapy (VMAT) was performed under general anaesthesia across 15 daily treatments. At the beginning of the VMAT course, the cat's clinical symptoms included bilateral hindlimb paresis but remained ambulatory. Gabapentin (18 mg $kg^{-1}$) was orally administered 2-3 hours before induction, which consisted of either intravenous propofol or alfaxalone, and maintenance with isoflurane (End-tidal concentration between 0.5-1.1%). Propofol (7.05 ± 0.35 mg $kg^{-1}$) was used in treatments 1, 3, 7, and 14; alfaxalone (3.40 ± 0.76 mg $kg^{-1}$) was used in all others.

In treatments 1 and 3, where propofol was used for induction, the time to regain hindlimb standing was estimated at 120–240 minutes based on clinical impression, appearing delayed compared to alfaxalone. To explore this, gait was video-recorded at 30 and 60 minutes post-extubation in treatments 7 (propofol; 7.0 mg $kg^{-1}$) and 8 (alfaxalone; 3.4 mg $kg^{-1}$). In treatment 7, the patient could not stand at 60 minutes, whereas in treatment 8, standing was possible. Continued observations suggested slower motor recovery with propofol. In treatment 14 (propofol; 7.5 mg $kg^{-1}$), the patient stood at 45 minutes, and no difference was noted compared to treatment 13 (alfaxalone; 3.0 mg $kg^{-1}$).

This observation suggests that anaesthesia induction with alfaxalone may promote earlier motor function recovery in feline patients with spinal disease when compared with propofol.

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5074

# Retrograde placement of an intrathecal catheter using a lumbar L4-L5 approach in a kitten

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Epidural catheter placement is a well-established analgesic technique, more commonly performed in dogs than in cats (Hasen 2001). When cranial advancement is not feasible, a retrograde approach has been described in dogs (Raillard et al. 2016). Accidental subarachnoid catheter placement has been reported in dogs (Shippy et al. 2021).

A 4-month-old, 2.3 kg male European Shorthair cat was referred after a car accident. Bloodwork and abdominal ultrasonography were unremarkable. The patient presented severe dorsolumbar soft tissue defect and urethral laceration. Radiographs revealed bilateral femoral head and multiple pelvic fractures. Computed tomography was excluded by financial constraints. Hospitalization included methadone (0.2 mg $kg^{-1}$ IV) and meloxicam (0.05 mg $kg^{-1}$ SC). Surgical debridement and prepubic urethrostomy were planned. For perioperative and postoperative analgesia, under general anaesthesia, a 24G epidural catheter was placed at L4-L5, where the skin was intact. Under radiographic guidance, the patient was positioned in lateral recumbency, and a 20G Tuohy needle (bevel caudally) was inserted. Epidural access was confirmed via the hanging drop and loss-of-resistance techniques. A prefilled catheter with Iohexol was advanced smoothly and additional 0.2mL contrast was injected. Radiographs revealed the catheter tip at L7 with contrast spreading to L2. Continuous dorsal and ventral contrast columns were consistent with subarachnoid placement. Epidural contrast contamination and air bubbles were likely due to loss-of-resistance technique (Figure).

Due to technical constraints, the catheter remained intrathecally. Analgesia was maintained with 0.25% bupivacaine (0.05 mL $kg^{-1}$) every 4 hours. The Glasgow pain score improved from 8/20 to 3/20, allowing systemic analgesia reduction to buprenorphine (0.01 mg $kg^{-1}$). The catheter remained in place for six days without complications.

Retrograde catheter placement is feasible in cats, offering an option when the conventional approach is impractical. However, there is a risk of subarachnoid placement in cats.

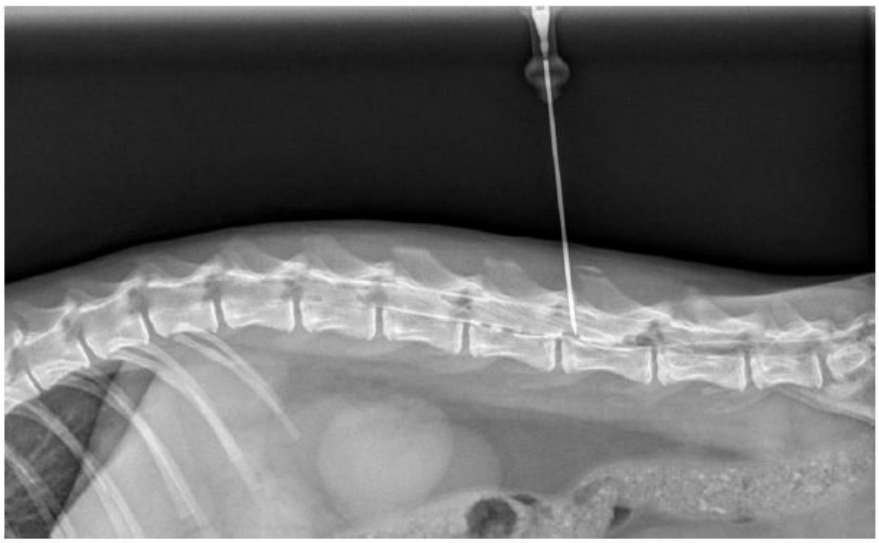

Figure 1: Laterolateral radiograph showing retrograde L4-L5 catheter insertion. Subarachnoid contrast columns, epidural contamination and air bubbles are visible.

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5077

# Nerve stimulator-guided mandibular block in a pig undergoing dental extraction

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Provision of appropriate analgesia in farm animal species is limited due to the acceptance of painful conditions. Dental disease is inherently painful, and locoregional anesthesia is an effective strategy for perioperative pain management

A 9-year-old castrated male Vietnamese pot-bellied pig (pet pig) weighing 41 kg was referred for treatment of a chronic abscess involving left mandibular canine tooth. On admission, physical examination, hematology and serum biochemistry were unremarkable. The pig underwent dental extraction under general anesthesia (methadone-midazolam-azaperone-dexmedetomidine- propofol-isoflurane). A nerve stimulator-guided mandibular block was planned to provide analgesia and anesthetic stability. Anatomical landmarks were determined preoperatively (Figure 1), and a nerve-stimulator needle was inserted. The nerve stimulator was initially set to a current of 1.0 mA and a frequency of 2 Hz. Upon eliciting contraction of the masticatory muscle, the needle position was adjusted until muscle contraction was present at 0.6 mA but absent at 0.3 mA. At this point, bupivacaine 0.5% 3 mL was injected. The surgical procedure was started 15 minutes after the block. Throughout the procedure, vaporizer dial was maintained between 1.25~1.75% without nociceptive response to surgery. Acute hypotension (MAP dropped from 60~65 to 40~50 mmHg) due to hemorrhage from inferior alveolar artery (estimated 3.5 mL kg-1) was managed by temporal discontinuation of isoflurane, colloid bolus, ephedrine and continuous rate infusions of norepinephrine and ketamine. Recovery from anesthesia was uneventful without complications associated with the block.

Use of a nerve stimulator-guided mandibular nerve block during dental procedures in swine provides precise local anesthetic delivery, promotes anesthetic stability, and prevents intraoperative nociceptive responses

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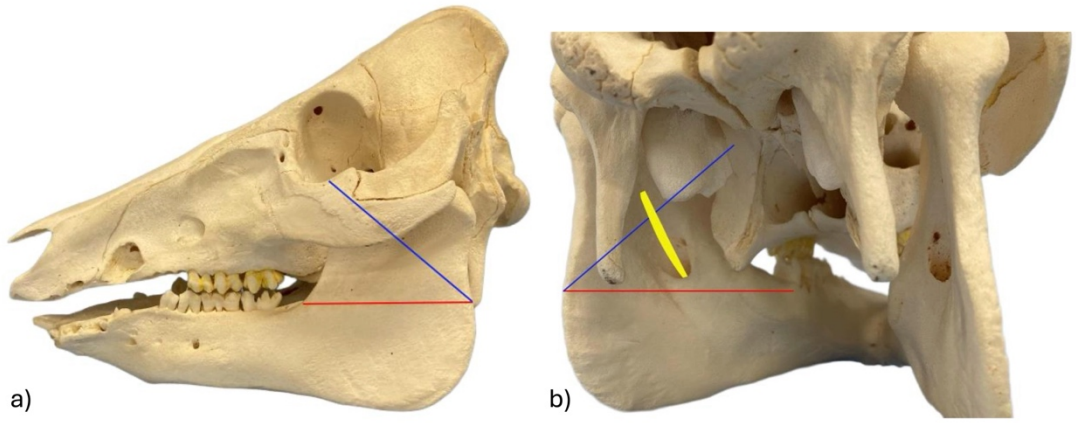


Disclosure
The clinical case described in this abstract was managed during the author's prior affiliation at Université de Montréal, Canada.

5097

## Incidence of emesis induced by low–dose intravenous administration of medetomidine in dogs: A retrospective study of 158 cases (2019-2024)

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Medetomidine induces emesis in dogs with a reported incidence of 8.8–33.3 %. However, prior studies predominantly used intramuscular doses of ≥ 30 μg $kg^{-1}$. This study aimed to determine the incidence of emesis in dogs receiving a lower dose of intravenous medetomidine.

Anesthetic records of dogs received ≤ 5 μg $kg^{-1}$ medetomidine intravenously before or after ≤ 5 μg $kg^{-1}$ fentanyl before anesthesia induction from January 2019 to December 2024 were evaluated retrospectively. Data collected included demographics, dose of medetomidine and fentanyl, administration order, emesis, retching, sialorrhea, and lip licking within 5 minutes after administration. Cases with diagnosed or suspected gastrointestinal or emetic disorders were excluded.

A total of 158 cases met the inclusion criteria, of which 44 dogs were administered in the order fentanyl–medetomidine (FM), and 111 dogs were administered in the order medetomidine–fentanyl (MF). Dogs were [median (range)] 99 (5–219) months old, weighed 8.8 (1.4–80.2) kg, Body Condition Score 3 (3–9), and American Society of Anesthesiologists–Physical Status class 2 (1–3). Administered doses of medetomidine were 3.0 (0.5–5) and fentanyl 3.0 (2–5) μg $kg^{-1}$. No statistical differences were found in these demographic parameters between the FM and MF groups. Incidence of emesis was 2 of 158 cases (1.3 %). Incidence of retching, sialorrhea, and lip licking was 1, 1, and 4 cases (0.63, 0.63, and 2.5 %), respectively. There were no statistical differences in these emetic signs between the FM and MF groups although both 2 cases of emesis were recorded only in the MF.

Results indicated that the incidence of emesis induced by ≤ 5 μg $kg^{-1}$ medetomidine intravenous administration was lower than that of previous reports investigated with the higher dose administration. In this study, fentanyl administration before medetomidine did not affect the incidence of emesis.

5099

## Impact of cephalic conformation on inhaled futicasone and salbutamol deposition in dogs: a computational study

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This *in-silico* descriptive study evaluates aerosol particle distribution and transport in dogs with different cephalic indexes, analysing the influence of airway morphology and particle size on drug delivery efficiency.

Computational fluid dynamics simulations were performed on geometric reconstructions of the upper airway and trachea from three healthy, client-owned dogs: a Whippet (dolichocephalic), a Malinois (mesocephalic), and a French Bulldog (brachycephalic). A 10 cm spacer with a spherical mask was adapted to each model (Figure 1). Analysis was conducted using Ansys CFX (Ansys Inc., Canonsburg, PA, USA) software, with a peak inspiratory flow of 1.125 L kg-1 min-1 (Rozanski et al. 1994) for the dolichocephalic and mesocephalic dogs, and 0.83 L kg-1 min-1 (Bernaerts et al. 2010) for the brachycephalic dog.

Simulations showed that particles primarily deposited in the device, muzzle, and nasal turbinates (Figure 2). Following a single inhalation, 0.84 [0.20-1.40] % and 1.17 [0-4.65] % of all particles reached the lungs in the dolichocephalic dog,

2.24 [0-4.45] % and 0.86 [0.05-1.85] % in the mesocephalic, for fluticasone and salbutamol respectly. In brachycephalic dogs, no particle reached the lungs, for either medication. The complex upper airway anatomy of brachycephalic dogs predisposes them to significant drug loss before reaching the bronchi.

These findings align with previous experimental studies in mesocephalic dogs, where 2.3±1.4% reached the lower respiratory tract of fluticasone (Chow et al. 2017), comparable to 1.97±1.4% of salbutamol in infants and children in radiolabeled studies. Optimizing inhalation protocols considering cephalic conformation is essential to improving drug delivery and therapeutic outcomes in canine respiratory emergencies and disease management.

**Figures:**

**Figure 1:**
Geometrical models. a. dolichocephalic, b. mesocephalic, c. brachycephalic.

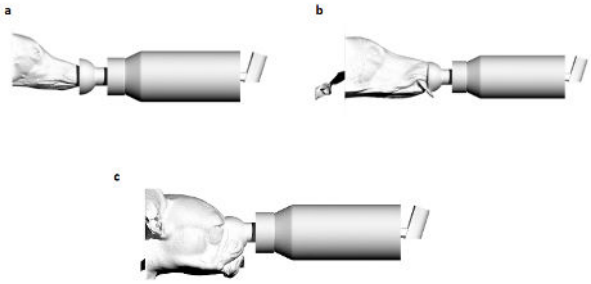
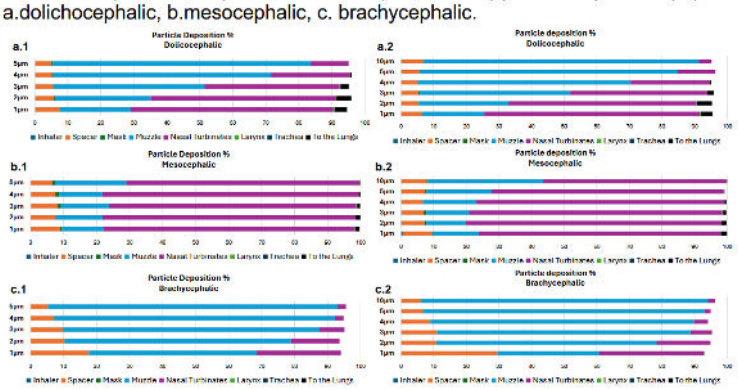



**Figure 2:**
Fluticasone (a.1, b.1, c.1) and Salbutamol (a.2, b.2, c.2) particle deposition (%).
a.dolichocephalic, b.mesocephalic, c. brachycephalic.

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**Acknowledgement**

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5109

# Evaluation of 2 mg $kg^{-1}$ Sugammadex for the Reversal of Moderate Rocuronium-induced Neuromuscular Blockade in Dogs

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Sugammadex reverses rocuronium-induced neuromuscular blockade (NMB) more rapidly than acetylcholinesterase inhibitors, yet its veterinary use remains limited. This study evaluated 2 mg $kg^{-1}$ sugammadex for reversing moderate rocuronium-induced NMB in dogs.

Twelve healthy adult client-owned dogs underwent the experiment preceding their elective surgery on the same day. Dogs were allocated to control (spontaneous recovery) or reversal (2 mg $kg^{-1}$ sugammadex) groups. Moderate NMB was defined as train-of-four (TOF) count = 1-3. Neuromuscular monitoring used acceleromyography in TOF mode, securing hindlimbs with a vacuum pillow, which allowed hock movement; 15 g preload applied if TOF ratio (TOFR) inconsistent. Recovery of NMB was defined as normalized TOFR ≥ 0.9. Following propofol induction without premedication and isoflurane maintenance (≥ 60 min), rocuronium 0.6 mg $kg^{-1}$ IV was given. Sugammadex was administered at first twitch (T1) return, with monitoring for 60 minutes post-NMB recovery. Recovery time was defined as T1 reappearance to normalized TOFR ≥ 0.9; recurarization was defined as TOFR < 0.9 after initial recovery. HR, SpO2, blood pressure, body temperature, and blood gas variables were recorded. Data are presented as median (range). Statistical comparisons used Mann–Whitney U, Fisher's exact, or two-way repeated-measures ANOVA. $P < 0.05$ was considered significant.

Total experiment duration was 223 (169-319) minutes. Recovery time was significantly shorter in the reversal group at 1.3 (0.8-3.0) minutes, compared to 18.6 (12.3-35.5) minutes in the control group. Time from TOF count = 0 after rocuronium administration to T1 reappearance was 24 (15.0-40.3) minutes in controls and 22.6 (21.3-27.8) minutes in reversals, with no significant difference. No recurarization was detected. Physiological and blood gas values remained within normal limits for isoflurane-anesthetized dogs, without significant differences.

In conclusion, 2 mg $kg^{-1}$ sugammadex effectively and rapidly reversed moderate rocuronium-induced NMB in dogs, with no evidence of recurarization during the 60-minute observation period.

5113

# Evaluation of the safety, tolerance, effective dose, and immunogenicity of a vaccine for the treatment of chronic osteoarticular pain

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Xep01 is an innovative developmental immunotherapy based on the recombinant fusion immunogen rNGFSP, designed to elicit antibodies against endogenous Nerve Growth Factor (NGF) and Substance P (SP), two key mediators of pain and inflammation in canine osteoarthritis (OA). This study evaluated its safety, tolerability, effective dose, and immunogenicity in healthy dogs.

Thirty healthy, mixed-breed shelter dogs (mean age 3.2 ± 1.6 years; mean weight 21.8 ± 6.9 kg; 57% male) were randomly assigned into five groups: four vaccinated with escalating antigen doses (10, 50, 100 µg) and two adjuvant concentrations (1% and 0.5% Montanide™ Gel 01), and one control group receiving excipient. All animals received a priming dose followed by three subcutaneous booster vaccinations every two weeks. Ethical approval was granted (CEUA-UdelaR #1649). Safety monitoring included serial clinical exams and hematological, biochemical, and coagulation analyses through day 56. Immunogenicity was assessed by ELISA measuring IgG titers against rNGFSP, native NGF, and SP.

No moderate or severe systemic adverse effects were observed. Clinical parameters, body weight, and behavior remained stable. Mild, transient subcutaneous indurations (1–3 cm) occurred in 34% of vaccine events in the 100 µg/1% group but resolved within 14 days. The 100 µg/0.5% group showed no reactions> cm. All vaccinated groups seroconverted, with anti-rNGFSP IgG titers peaking at 1:24,000 in the 100 µg/1% group. Cross-reactive IgG titers against NGF and SP reached 1:8000 and 1:1200, respectively, in the 100 µg/0.5% group, with seroconversion rates of 85% (NGF) and 73% (SP).

These findings support the safety and immunogenic potential of Xep01, justifying further clinical development as a novel therapeutic class for OA pain.

5118

# Two-point rectus sheath block technique results in more extensive dye spread in the abdominal wall than one-point technique in dog cadavers

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Some abdominal fascial plane blocks described in the literature have a more significant spread when a multiple-point technique is used. The goal of this study was to develop a two-point ultrasound-guided rectus sheath block (RSB2) and compare it to the currently described single-point technique (RSB) in dogs.

This prospective study used eight dog cadavers. Each dog received both techniques (RSB and RSB2) assigned randomly to right or left hemiabdomen. Equal volumes of methylene blue were used per hemiabdomen (RSB - 0.5 mL kg-1 and RSB2 0.25 mL kg-1 per injection site with a total of 0.5 mL kg-1). For RSB2, a cranial injection was performed by placing the transducer parallel with the costal arch. For the caudal injection, the transducer was placed in transverse orientation like RSB, but 2 cm caudal to umbilicus (as opposed to 1 cm cranial to the umbilicus - RSB). Dissections were performed to assess the extent of dye spread with each technique. Normality was assessed using the Shapiro-Wilk test, and data was confirmed to be nonparametric, so Mann-Whitney test was used.

More ventral branches of spinal nerves were stained in the RSB2 compared to RSB (6 [5 - 7] and 4.5 [4 - 6], respectively; $p = 0.023$). The greater dye distribution in the RSB2 was preferentially cranial to umbilicus. The incidence of specific thoracic (T) and lumbar (L) nerves staining following RSB and RSB2 techniques were respectively: T9 (12.5% and 25%), T10 (25% and 75%), T11 (50% and 100%), T12 (100% and 100%), T13 (100% and 100%), L1 (100% and 100%), L2 (87.5% and 75%) and L3 (0% and 25%).

The RSB2 resulted in more extensive abdominal dye spread, especially cranially; and overall, a greater number of nerves stained when compared to RSB using the same total volume of injectate.

5121

# Comparison of unilateral versus bilateral erector spinae plane block for intraoperative antinociceptive effect in dogs undergoing hemilaminectomy: a prospective randomized clinical trial

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The erector spinae plane block (ESPB) has recently gained interest for dogs undergoing hemilaminectomy (Portela et al. 2020, Bendinelli et al 2024). It appears that the cutaneous and spinal nerves cross or communicate across the midline (Capek S et al. 2015). This study compares the intraoperative efficacy of unilateral versus bilateral ESPB in controlling nociception in dogs undergoing thoracolumbar hemilaminectomy (ECAE 15/CESA/2024).

Healthy dogs were randomly assigned to receive either unilateral (group UNI, n = 18) or bilateral (group BIL, n = 18) ESPB. Dogs received methadone (0.1 mg kg–1) intramuscularly (IM), intravenous propofol to effect and isoflurane in oxygen. Dogs were mechanical ventilated to maintain end-tidal isoflurane concentration between 1.2% and 1.3% and end-tidal carbon dioxide partial pressure (PÉCO2) between 35 and 45 mmHg. Heart rate (HR), invasive arterial blood pressure (IABP), respiratory rate were monitored. Nociceptive event was defined as an increase in HR and/or APB of 20%. Intraoperative nociception was treated with fentanyl bolus (1 µg kg–1) IV, if another nociception treatment was necessary fentanyl bolus followed by 3 µg kg–1 h-1 constant rate infusion IV was administered. Anaesthesia time, intraoperative complication (bradycardia and/or hypotension), surgery time, incidence of nociceptive events and cumulative dose of fentanyl were recorded and compared between groups. A Student's t test was used to compare data between groups.

No differences were detected between groups regarding duration of surgery ($p = 0.26$), anaesthesia time ($p = 0.93$). There were no intraoperative complications in both groups. The intraoperative fentanyl requirement ($p = 0.63$) and total fentanyl consumption ($p = 0.70$) were not different between groups.

In dogs receiving methadone-propofol-isoflurane and unilateral or bilateral ESPB, no differences were observed regarding intraoperative requirements for rescue analgesia during hemilaminectomy. Unilateral ESPB might be a valuable option.

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5123

# Intraperitoneal nebulization of ropivacaine 1% for perioperative analgesia in dogs undergoing laparoscopic ovariectomy: a randomised clinical tria

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[4] Private Practice Milan, Italy

The instillation of intraperitoneal local anesthetics (IPLA) reduces pain and perioperative opioid consumption in both human and veterinary patients (Lambertini et al. 2018; Dai et al. 2022). Clinical trials in humans have demonstrated the advantages of nebulization techniques over traditional IPLA instillation (Ingelmo et al. 2010). This study evaluates the perioperative and postoperative efficacy of intraperitoneal nebulization of ropivacaine using the Aeroneb Pro® device for pain relief in dogs undergoing laparoscopic ovariectomy.

Thirty-two healthy dogs were randomly assigned to receive either 3 mg $kg^{-1}$ intraperitoneal ropivacaine 1% nebulization (group ROPI, n = 16) or no treatment (group CNTR, n = 16). Anesthesia was induced with fentanyl (5 µg $kg^{-1}$ intravenously IV), propofol IV to effect, and maintained with isoflurane in oxygen. Ropivacaine was nebulized via the laparoscopic port at the start of pneumoperitoneum. Intraoperative nociception was managed with additional fentanyl (1 µg $kg^{-1}$ IV), and the incidence of nociceptive events along with cumulative fentanyl dose were recorded. Postoperative pain was assessed using the short form of the Glasgow Composite Pain Scale (SF-GCPS), and rescue analgesia was administered with meloxicam (0.2 mg $kg^{-1}$ subcutaneously) and methadone (0.2 mg $kg^{-1}$ intramuscularly) as needed. Data were analyzed using Student's t-test or Mann-Whitney test.

No differences were found between groups in surgery duration ($p = 0.16$), pneumoperitoneum duration ($p = 0.17$), or intraoperative fentanyl use ($p = 0.34$). Pain scores were significantly higher in the CNTR group during the first 3 hours postoperatively ($p < 0.001$), and all dogs required rescue analgesia, instead only 6.3% of dogs in the ROPI group needed postoperative rescue treatment.

Intraperitoneal nebulization of ropivacaine provided effective postoperative analgesia in dogs undergoing laparoscopic ovariectomy, resulting in lower pain score and less rescue analgesia administration compared to the control group.

5124

# Dynamic changes in the arterial partial pressure of carbon dioxide–end-tidal carbon dioxide gradients and cardiopulmonary variables during canine laparoscopic surgery

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Laparoscopic surgery requires careful anesthesia due to capnoperitoneum (Srivastava et al., 2010). This study evaluated the difference between arterial partial pressure of carbon dioxide ($PaCO_2$) and end-tidal carbon dioxide ($ETCO_2$) before and after capnoperitoneum, assessing $ETCO_2$'s utility.

Eight healthy female mongrel dogs underwent laparoscopic-assisted ovariectomy, ovariohysterectomy, or gastropexy. Anesthesia was induced with intravenous propofol and maintained with isoflurane in oxygen (40 mL $kg^{-1}$ $min^{-1}$). Pressure-controlled ventilation maintained $ETCO_2$ between 35–50 mmHg. Dexmedetomidine (10 µg $kg^{-1}$, intramuscular) was administered for analgesia. Fentanyl (0.5-1 µg $kg^{-1}$, intravenous bolus or constant rate infusion) was given when heart rate or blood pressure exceeded baseline by 20%. Robenacoxib (2 mg $kg^{-1}$, subcutaneous) was administered prior to recovery. Arterial blood samples from the dorsal pedal artery and corresponding mainstream $ETCO_2$ values were collected at five time points: baseline (T0), 15 minutes after dexmedetomidine (T0dex), 10 and 40 minutes after capnoperitoneum (T1, T2), and 10 minutes post-deflation (Tend). Cardiopulmonary variables were recorded every 5 minutes. Due to small sample size and non-parametric distribution, results are presented as medians with interquartile ranges. $PaCO_2$, $ETCO_2$, and their gradients were analyzed using the Wilcoxon signed-rank test. Agreement between $PaCO_2$ and $ETCO_2$ was assessed via Bland-Altman analysis with non-parametric limits of agreement.

The $PaCO_2$–$ETCO_2$ gradient significantly increased at T1, T2, and Tend compared to T0, rising from −0.5 (−4.75 – 3.75) mmHg to 3 (−1.75 – 5.75) mmHg, 4.5 (2.5 – 6) mmHg, and 4 (1.25 – 6) mmHg, respectively. The mean bias between $PaCO_2$ and $ETCO_2$ increased over time, while the limits of agreement remained approximately consistent across time points.

Between T1 and T2, the increasing bias indicates that $ETCO_2$ may underestimate $PaCO_2$. However, the discrepancy remained within acceptable limits, suggesting $ETCO_2$ may be useful for trend monitoring during short-term laparoscopic procedures in healthy dogs. Further studies are required to determine its reliability as a direct substitute for $PaCO_2$.

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5128

# Reverse Trendelenburg attenuates hemodynamic depression during anesthesia in late-gestation mares

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Pregnancy increases the risk of hemodynamic depression during inhalation anesthesia in mares. This study compared reverse Trendelenburg (RT) with standard dorsal recumbency in late-term pregnant mares (> 300 days) undergoing anesthesia.

Eighteen mares were allocated into three groups (n = 6): non-pregnant (CONTROL), pregnant (D), and pregnant with RT (DRT). They received IV xylazine (1 mg $kg^{-1}$), followed by IV ketamine-midazolam (2.2 mg $kg^{-1}$, 0.1 mg $kg^{-1}$) and isoflurane (1.5 MAC) under controlled mechanical ventilation (PIP 35–40 mmHg; fr 10 breaths $min^{-1}$; I:E ratio 1:2; VT 10 mL $kg^{-1}$ $min^{-1}$). HR (beats $min^{-1}$), $SpO_2$ (%), MAP (mmHg), cardiac output (CO; L $min^{-1}$), pulmonary artery pressure (PAP; mmHg), and central venous pressure (CVP; mmHg) were recorded. CO was obtained by Swan-Ganz thermodilution (Muir et al., 1976). Stroke volume (SV; mL $beat^{-1}$) and systemic vascular resistance (SVR; dyn s $cm^{-5}$) were calculated. Data were analyzed using ANOVA with Tukey's post hoc test for intergroup and Dunnett's test for baseline comparisons ($p < 0.05$).

From 30 minutes, HR increased in DRT (76 ± 24), remaining higher than CONTROL ($p < 0.05$). MAP increased over time in D, and at 60 minutes was highest in CONTROL (72 ± 7), followed by D (60 ± 6) and DRT [(50 ± 10), $p < 0.05$] CVP was lower in D (–1.5 ± 4.2) at 60 minutes compared to CONTROL (5.1 ± 6.2) and DRT [(4.9 ± 4.7), $p < 0.05$]. CO increased in DRT from 10 minutes (34.1 ± 10.1), surpassing CONTROL at 10 and 60 minutes ($p < 0.05$). SV was higher in CONTROL at 30 (686.8 ± 185.1) and 60 minutes [(551.3 ± 141.4), $p < 0.05$].

RT positioning was associated with cardiovascular adaptations – increased HR and CO, reduced SV, and lowing MAP. The CVP findings suggest that RT recumbency may partially alleviate pregnancy-related venous return impairment.

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## Acknowledgments

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5138

# Creation of digital and 3D printed models to teach the mechanisms of action and functions of benzodiazepines (BZD) in veterinary anesthesiology

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Benzodiazepines (BZD) are commonly administered as preanesthetic medications in veterinary practice. Understanding the mechanisms of action and function of these compounds in patient animals is thus of utmost importance when training in veterinary medicine. This subject is typically taught through expository lectures using flat diagrams. However, the use of three-dimensional models could increase students' learning levels and reduce the degree of abstraction related to BZDs.

Therefore, the present study aimed to create and evaluate 3D models representing benzodiazepine drugs and their binding sites. We hypothesized that 3D models of benzodiazepines (BZDs3D) (figure 1) could be used effectively as teaching tools, making it possible to learn about the mechanisms of action and their functions during the training of veterinary medicine students. Fifty-two students from a veterinary medicine course took part in the study and were divided equally into two groups: the 3D group (G3D), students who used BZDs3D, and Control Group (CG), students who used flat schemes for learning. A pre-test, post-test, and satisfaction questionnaire (each comprising ten questions) were used to assess the performance of the students in both groups.

Between the pre- and post-tests, the G3D group showed greater improvements in their scores than the CG, suggesting that BZDs3D was effective at promoting student learning (figure 2 and 3). The satisfaction evaluation revealed good acceptance of the methodology employed.

The use of 3D printed models can contribute to learning pharmacology and anesthesiology.

**Funding**

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Figure 1. (A) GABAa receptors with open channels containing BZD (black cube) and GABA (gray sphere) at their respective binding sites. (B) The GABA a receptor with a closed channel containing BZD (black cube) and GABA (gray sphere) at their respective binding sites is inserted into the cytoplasmic membrane.

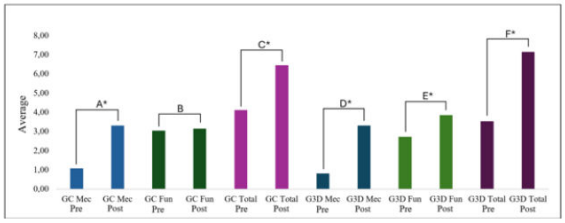


Figure 2. Mean scores for the pre- and post-tests of question regarding the mechanism of action (Mec) and function (Fun) for the CG and G3D. p-values: A: $p < 0.001$; B: $p = 0.549$; C: $p < 0.001$; D: $p < 0.001$; E: $p < 0.001$; F: $p < 0.001$. *Statistical difference.

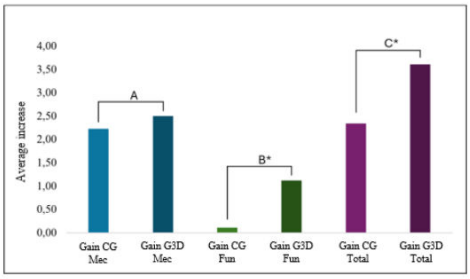


Figure 3. The average gain in scores between the pre- ans post-tests in the CG and G3D (Difference between post-test and pre-test score). P-values: A: $p = 0.513$; B: $p = 0.004$; C: $p = 0.023$. CG (Control Group), G3D (3D Group), Fun (questions related to BZD function), Mec (questions related to BZD mechanism of action), Total (all mechanism of action and function questions). *Statistical difference.

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# Onset and duration of action of escalating doses of rocuronium in anesthetized healthy goats

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Multimodal anesthesia is becoming more common across veterinary species, illustrated with an increased awareness of using neuromuscular blocking agents. Only atracurium dose has been reported in goats. This study aimed to determine the onset and duration of action of three doses of rocuronium in healthy anesthetized goats.

In a triple crossover design, nine female goats aged 21 to 71 months and weighing 36 to 87 kgs were anesthetized with propofol (6.00 ± 0.52 mg $kg^{-1}$) and isoflurane in 100% oxygen. Three doses of rocuronium 0.05 mg $kg^{-1}$ (RC05), 0.1 mg $kg^{-1}$ (RC1), and 0.2 mg $kg^{-1}$ (RC2) were randomly assigned and administered with a minimum one-week washout. Neuromuscular blockade was monitored using acceleromyographic train-of-four (TOF) every 15 seconds post-administration to determine the onset of paralysis (TOF = 0). Return of first twitch (TOF>) and duration of action (TOF = 100%) were determined by repeat TOF every 5 minutes. Data were analyzed using Wilcoxon tests. A $p < 0.05$ was used for significance and data are reported as median (range).

Paralysis (TOF = 0) occurred in 11% of RC05, 89% of RC1 and 100% of RC2. Data for RC05 was not further analyzed. Onset was 2 (1-4) minutes for RC1 and 2 (2-6) minutes for RC2 ($p = 0.5$). Return of first twitch was 35 (10 – 40) minutes for RC1 and 72.5 (50-210) minutes for RC2 ($p = 0.0312$). Duration of action was 105 (60-125) minutes for RC1 and 162.5 (125-260) minutes for RC2 ($p = 0.0078$). Variations in heart rate and arterial blood pressure within groups RC1 and RC2 were not observed.

At the doses tested, rocuronium at 0.2 mg $kg^{-1}$ resulted in effective neuromuscular blockade in all goats in this study.

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# Use of tranexamic acid in dogs undergoing corrective osteotomy surgery

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The use of an antifibrinolytic drug, such as tranexamic acid, can minimize blood loss during surgery, as it is an adjunct in bleeding control. This drug is widely used in human orthopedic surgery with a high degree of bleeding (more than 500 mL) which often requires blood transfusion. The aim of this study was to evaluate the effectiveness of tranexamic acid in dogs undergoing surgery with great potential of blood loss.

Twenty-one animals with ruptured cruciate ligament or patellar luxation, undergoing corrective osteotomy under general and local anesthesia, were divided in two groups. The first group received tranexamic acid as a bolus, at the time of induction, at a dose of 10 mg $kg^{-1}$ followed by continuous infusion at the rate of 1 mg $kg^{-1}$ $hour^{-1}$ (GAT). The second group received saline solution 0.9% in a corresponding volume (GSS). Estimation of blood loss was made by weighing surgical drapes and gauzes when dry and then when soaked in blood. Serum lactate and fibrinogen, coagulation times (prolonged activated partial thromboplastin time - aPTT - and prothrombin time - PT), blood count and blood gas analysis were registered at three specific moments during the procedure: TB (baseline), T1 (1 hour after anesthesia induction) and T2 (immediately before the end of procedure). Statistical analysis was performed by ANOVA for repeated measurements, followed by Tukey and t-Student's test; values with $p < 0.05$ were considered significant.

There were no statistical difference between groups regarding any of the parameters, including blood loss measures (table 1). GAT presented a blood loss of 8.35 ± 5.03 mL $kg^{-1}$ and GSS 7.99 ± 4.3 mL $kg^{-1}$ ($p = 0.77$).

Therefore, tranexamic acid was not effective in reducing blood losses in dogs undergoing corrective osteotomies.

Table 1 – Blood loss values in total volume (mL), percentage of patient's weight (%) and relation to patient's weight (mL $kg^{-1}$) from the groups studied during corrective osteotomies in dogs (n = 21) (mean ± SD)

| Group | Volume (mL) | Percentage (%) | Relation (mL $kg^{-1}$) |
|---|---|---|---|
| **GAT** | 320,85 ± 184,22 | 0,89 ± 0,50 | 8,35 ± 5,03 |
| **GSS** | 309, 45 ± 182,10 | 0,83 ± 0,43 | 7,99 ± 4,3 |

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5155

# Simulator for training ultrasound-guided thoracic locoregional blocks in dogs

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Performing ultrasound-guided thoracic blocks (UGTB) requires anatomical knowledge and ultrasound interpretation. The objective was to develop a simulator for UGTB training (US-GTB).

The study was conducted at the Fluminense Federal University/Brazil, without the use of live animals or cadavers. The simulator was based on canine thoracic anatomy and ultrasound. The layers representing the skin and muscles were produced with silicone and the rib cage by a 3D printer. The images were generated with ultrasound with a 5-10 MHz linear probe and with the use of a 21Gx100mm peripheral block needle. The simulator was tested by 05 anesthesiologists with experience in ultrasound-guided locoregional blocks. The anesthesiologists captured the images, without knowing which anatomical structures were reproduced. They described the anatomical structures and related the body region that the simulator represented during palpation and evaluation of the US-GTB. Subsequently, they used a needle to mimic the performance of the blocks.

Palpation allowed the delimitation of the thoracic cage and the identification of the ribs and intercostal spaces. The images allowed the identification of muscles, parietal pleura and ribs. The simulated musculature had echogenicity and depth compatible with the thoracic wall of an adult dog. The acoustic shadows of the ribs were visualized for cavity delimitation. The simulation of the intercostal block was performed by positioning the needle on the caudal edge of the ribs. The serratus block occurred after a needle passed through different muscle layers of the US-GTB, mimicking the deposition of the anesthetic between the muscles. The simulator represented the canine thoracic wall, allowing manipulation, ultrasound visualization and the performance of locoregional blocks, such as the serratus plane and intercostals by all anesthetists.

The US-GTB seems to be a tool for training anatomical identification and for performing UGTB.

**Funding**

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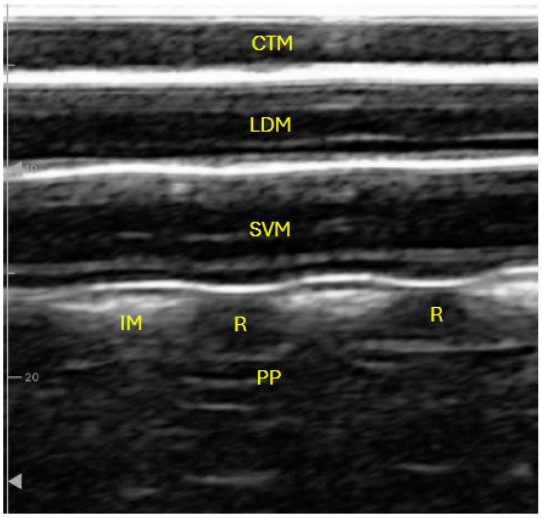


Acoustic window of the thoracic portion of the simulator, obtained using a 10 MHz linear transducer. CTM=muscle cutaneuos trunci. LDM= muscle latissimus dorsi. SVM=muscle serratus ventralis. R=Rib. IM=muscles intercostales. PP=parietal pleura.

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# Anesthetic management and perioperative complications in dogs undergoing transvenous pacemaker implantation: A retrospective study

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Transvenous pacemaker implantation in dogs requires specialized anesthetic management due to underlying cardiac disease and perioperative instability. This study aimed to describe anesthetic protocols, complications, and outcomes associated with dog pacemaker implantation procedures.

A retrospective review was conducted on 18 anesthetic procedures in 16 dogs at the UFAPE Veterinary Hospital (2024–2025). Collected data included ASA classification, cardiac diagnosis of electrocardiogram, echocardiogram, and/or Holter, anesthetic protocols, intraoperative monitoring, and complications. Hypotension was defined as mean arterial pressure (MAP) ≤60 mmHg, and hypertension as MAP> mmHg. Parametric data were analysed using paired t-tests, and non-parametric data with Mann-Whitney. Then, a comparison of intraoperative haemodynamic parameters was performed between dogs premedicated with butorphanol and those that received no premedication. The population included 16 dogs (50% male, 50% female), with a median age of 6 years (range 1–12) and a median weight of 8.9 kg (range 3.1–40). The third-degree atrioventricular block was the primary indication (75%). Premedication with butorphanol was used in 50% of cases, acepromazine in 5.5%, while 44.5% received no premedication.

Dogs receiving butorphanol showed a higher incidence of intraoperative normotension compared to those without premedication for SAP and MAP ($p < 0.05$). Induction protocols included ketamine-midazolam (33.3%), ketamine-midazolam combined with etomidate or propofol (38.8%), propofol-based protocols (11.1%), and etomidate-based protocols (11.1%). Maintenance predominantly used ketamine-midazolam infusions combined with isoflurane after implanting the pacemaker (66.6%). Complications included hypotension (27.7%), hypertension (55.5%), electrode displacement (11.1%), and one cardiac arrest (5.5%) due to external pacemaker malfunction, successfully reanimated. All dogs survived the perioperative period.

Individualized anesthetic protocols provided adequate hemodynamic control and favourable outcomes. The use of butorphanol as premedication was associated with better haemodynamic stability intraoperatively due to the minor requirement of induction agents, while dogs without premedication.

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# Three-dimensional models for teaching the mechanisms of action of phenothiazines and butyrophenones in veterinary anesthesiology

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Phenothiazines (FNZ) and butyrophenones (BUT) are commonly used as sedatives in veterinary anesthesia. The greatest difficulties that students face when studying the mechanisms of action of these drugs involve spatial perception and the configuration of these molecules. Therefore, the study aimed to evaluate the use of three-dimensional (3D) models representing the mechanisms of action of FNZ and BUT as tools in the teaching and learning of veterinary anesthesiology.

Thirty-eight students participated in the study and were divided into two groups: the 3D group (3DG), composed of students who studied using 3D models, and the Control Group (CG), in which students studied using flat diagrams. Pre- and post-tests were administered to assess the level of knowledge of the students regarding the mechanism of action and functions of FNZ-BUT. The tests were worth 10 points. The questions applied were the same as those used previously to assess student learning, even in the absence of study. The pre- and post-test scores for GC and G3D were assessed by the normality test, followed by the paired Student's t-test. The unpaired Student's t-test was used to assess the mean gain between the groups. A reliability level of 5% was used.

Only the G3D group showed significant improvements between the pre- and post-tests regarding the mechanism of action ($p = 0.010$; 1.79±0.92 (pre-test) to 2.58±1.07 (post-test)) and function ($p = 0.001$; 2.26±1.10 (pre-test) to 3.16±1.07 (post-test)). The mean score gain was significant for G3D students (0.79±1.08 points), with a significant difference in the mechanism of action ($p = 0.043$) compared to CG (0.11±0.99 points).

These results indicate that the use of 3D models was more efficient than the use of flat diagrams in promoting learning about FNZ-BUT.

**Funding**

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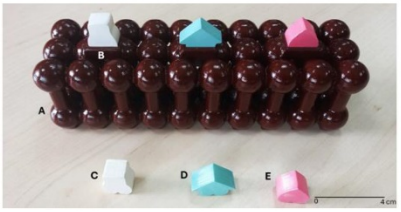


Figure 1. Models after painting and varnishing. (A) Cytoplasmic membrane. (B) Dopamine receptor linked to a BUT. (C) BUT. (D) FNZ. (E) Dopamine.

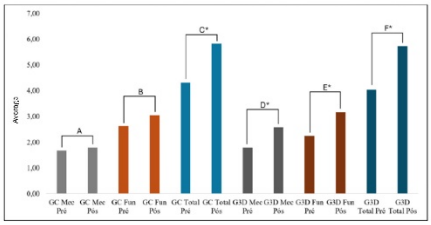


Figure 2. Mean scores for the pre- and post-tests, considering the mechanism of action (Mec) and function (Fun) for the CG and G3D. p-values: A: p = 0.581; p = 0.176; C: p <0.001; D: p = 0.010; E: p = 0.001; F: p < 0.001. *Showed statistical difference. CG, control group; G3D, 3D group. Maximum possible score (10 points)

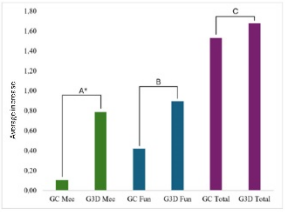


Figure 3. Average gain in scores between the pre- and post-tests in the CG and G3D. p-values: A: p = 0.043; B: p = 0.108; C: p = 0.833. CG (Control Group), 3D (3D Group), Fun (questions related to the function of FNZ-BUT), Mec (questions related to the mechanism of action of FNZ-BUT), Total (all mechanism of action and function questions). *Showed statistical difference. FNZ, phenothiazines; BUT, butyrophenones.

5164

# Pulsed radiofrequency treatment for the management of trigeminal-mediated headshaking syndrome in a horse

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Trigeminal-mediated headshaking syndrome (TMHS) is a chronic neuropathic condition in horses, likely involving trigeminal nerve dysfunction (Roberts, 2019). Pulsed radiofrequency (PRF), a minimally invasive neuromodulatory technique, is used to treat human trigeminal neuralgia.

This case report describes the application of PRF to the infraorbital nerves in a 14-year-old Quarter Horse mare diagnosed with severe (grade 3) (Talbot et al., 2013) idiopathic TMHS. The horse achieved a baseline total score of 59% on the History, Rest and Exercise Score (HRE-S) (Kloock et al., 2024), with partial scores of 100% for History (H-S), 30% for Resting (R-S) and 47% for Exercise (E-S). Following owner's written consent, standing sedation (acepromazine 0.03 mg $kg^{-1}$, xylazine 1 mg $kg^{-1}$, butorphanol 0.02 mg $kg^{-1}$) and retrograde maxillary nerve blocks (2.5 ml lidocaine 2% + 2.5 ml ropivacaine 1%) were administered. An 18 SWG, three-tined, 5-mm active tip, 100-mm radiofrequency needle was inserted into the infraorbital foramen under ultrasound guidance and advanced 9 cm into the infraorbital canal. Each infraorbital nerve received PRF at 42 °C and 50 Volt for 15 minutes.

Six weeks post-treatment, clinical signs improved to grade 2, with a 47% reduction in HRE-S (31%; H-S: 75%, R-S: 9%, E-S: 8%) and sustained relief for 12 months. Gradual symptom recurrence began at 13 months, prompting a second PRF at 16 months (grade 3; HRE-S: 58%, H-S: 100%; R-S: 24%; E-S: 50%), which led again to marked improvement to grade 1 at 6 weeks post-second-treatment, with a 59% reduction in HRE-S (24%; H-S: 63%, R-S: 0%, E-S: 10%), sustained until 6 months post-second-treatment. No adverse effects were observed.

Pulsed radiofrequency provided long-term pain relief, though complete symptom remission was not achieved. Further trials are needed; nonetheless, these results suggest PRF may be safe, effective neuromodulatory treatment for temporarily managing equine TMHS and improving quality of life.

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5265

# Pharmacopuncture and intravenous low dose dexmedetomidine provide equivalent sedation in healthy horses

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Da Feng Men (DFM) is an acupoint used for relaxation in horses as a site analogous to the acupoint governing vessel 20 in dogs (Xie, 2007). This study evaluated the sedative effects of dexmedetomidine injected at acupoint DFM.

Ten horses received four treatments in a randomized, blinded, crossover design: (1) dexmedetomidine (DexmedDFM, 1 µg $kg^{-1}$) or (2) saline (SalDFM) administered at DFM (3) dexmedetomidine administered subcutaneously on the lateral neck (DexmedSC, 1 µg $kg^{-1}$), or (4) dexmedetomidine administered intravenously (DexmedIV, 1µg $kg^{-1}$). FaceSed (Oliveira et al. 2021), EquiSed, (de Oliveira et al. 2021), head height above ground (HHAG), HR and *f*r were collected at baseline and 5, 15, 30, 45, 60 and 90 minutes after treatment. FaceSed, EquiSed and HHAG were compared with pairwise Wilcoxon signed rank test (Sidak's method). HR and *f*r were not included in the statistical analysis. Statistical significance was set at $p < 0.05$.

There were no statistical differences in sedation scores between groups at any timepoints. Maximal median (range) of FaceSed, EquiSed and minimal median HHAG are presented in Table 1. FaceSed was significantly higher at all time points in DexmedDFM and SalDFM, at T15, T30, T60 and T90 in Dexmed SC and at T5, T15, T30, T45, T60 in DexmedIV. EquiSed was significantly higher at T5 and T60 in DexmedDFM, T30 and T45 in SalDFM, T45, T60, T90 in DexmedSC and T5, T15, T30, T45, T60 in DexmedIV. Head height was significantly lowered at T60 in DexmedDFM and T5, T30, T45 and T60 in DexmedIV.

All treatments resulted in variable sedation. Dexmedetomidine administered subcutaneously at DFM provided sedation not significantly different from alternative treatment sites.

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| Median [range](time) | DexmedDFM | SalDFM | DexmedSC | DexmedIV |
|---|---|---|---|---|
| Max FaceSed (/8) | 3.8 [3;4] (T45) | 3.0 [2;4] (T30) | 3.8 [0.5;4] (T15) | 3.5 [1.5;5] (T30) |
| Max EquiSed (/18) | 7.8 [3.5;10.5] (T15) | 9.5 [7;11] (T30) | 9.5 [7;9.5] (6.5;11.5) | 10.8 [9.5;11] (T15) |
| Min HHAG (cm) | 102.5 [90;111.5] (T45) | 107.3 [105;112] (T60) | 106.3 [93;111] (T30) | 102.5 [97.5;109.5] (T30) |

Table 1. Timepoints of Maximal median of FaceSed, EquiSed and minimal median of HHAG per group.

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# Efficacy of tramadol for the management of acute postoperative pain in cats: a systematic review of clinical trials

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Tramadol is widely used in feline postoperative pain management; its clinical efficacy and optimal dosing remain unclear. This systematic review aimed to evaluate the effectiveness and safety of tramadol in feline surgical patients.

A structured search was performed between January 2025 and March 2025 in PubMed, Web of Science, CAB Abstracts and Google Scholar. Eligible studies included randomized controlled trials comparing tramadol to placebo or other analgesics, reporting postoperative pain outcomes using validated pain scales. The primary outcome was the number of animals requiring postoperative rescue analgesia. Secondary outcomes included the highest pain scores on validated scales and the incidence of adverse effects. Studies assessing chronic pain or using non-validated scales were excluded.

Seven clinical trials were included (Figure 1). Risk of bias was assessed using Cochrane's tool and was considered low across all studies. Brondani et al. (2009) and Schimites et al. (2023) included control groups and reported reduced pain scores with 2–4 mg $kg^{-1}$ of tramadol, alongside clear rescue protocols. Evangelista et al. (2014) found that 4 mg $kg^{-1}$ IM tramadol eliminated the need for rescue analgesia. Bauquier (2022) showed both oral and IM tramadol were effective. Goich et al. (2024) reported high intraoperative rescue needs at 3 mg $kg^{-1}$ but similar postoperative pain scores to morphine and methadone. Cagnardi et al. (2011) focused on pharmacokinetics and intraoperative response, with limited postoperative data. Steagall et al. (2008) assessed experimental rather clinical pain, limiting external validity. Ovariohysterectomy was the surgical model in most of the included studies and few adverse effects were reported.

This systematic review provides a comprehensive synthesis of current evidence on tramadol for acute postoperative pain in cats, highlighting its potential efficacy. Despite variability across studies, our findings offer a valuable foundation for future meta-analysis and clinical decision-making aimed at optimizing feline analgesia

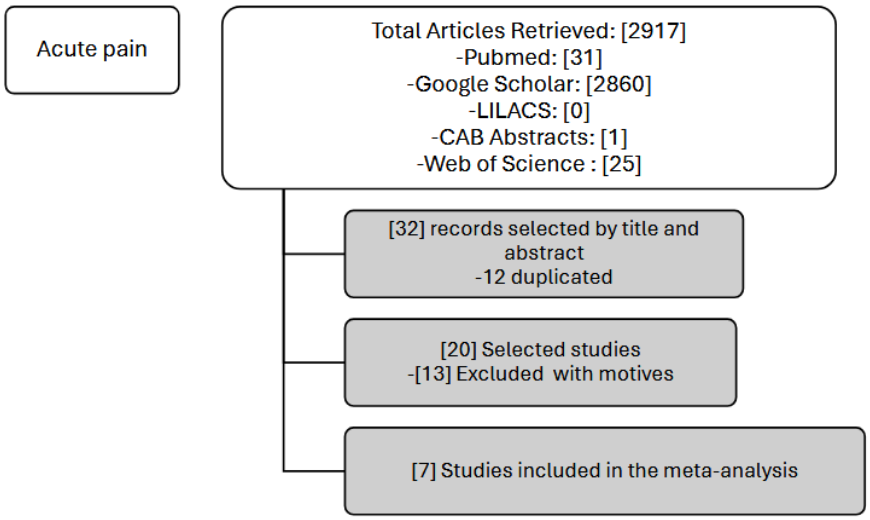


Figure 1: study flow diagram.

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# Morbidity and mortality related to anaesthesia for experimental myocardial infarction induction: lessons learnt from minipigs

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Spontaneously occurring myocardial infarction is a life-threatening condition in humans. We aim at reporting morbidity and mortality related to anaesthesia for experimentally induced closed-chest myocardial infarction in minipigs.

Thirty-six Göttingen minipigs underwent left coronary catheterization via femoral access, followed by ballon inflation and occlusion of the left anterior descending artery (ischemia: 90 minutes) and deflation (reperfusion: 120 minutes). Minipigs were sedated with ketamine 10 mg $kg^{-1}$, dexmedetomidine 15 µg $kg^{-1}$ and morphine 0.2 mg $kg^{-1}$ IM. Anaesthesia was induced with propofol 1-3 mg $kg^{-1}$ and ketamine 1 mg $kg^{-1}$ IV and maintained with sevoflurane (max 1 MAC: 2.2% Et) and lidocaine (30 µg $kg^{-1}$ $minute^{-1}$). Dexmedetomidine 1-5 µg $kg^{-1}$ $hour^{-1}$ was added unless bradycardia was present. Amiodarone 5 mg $kg^{-1}$ was administered before coronary occlusion. At recovery, minipigs received IV meloxicam 0.4 mg $kg^{-1}$, furosemide 2.5 mg $kg^{-1}$ and nitro-glycerine 0.2 mg over 30 minutes. We recorded intraoperative mortality, 72 hours mortality, and the incidence of cardiopulmonary resuscitation (CPR), electrical rhythm conversions, intraoperative nociception, post-operative pain, intra and post-operative arrhythmias.

An intra-operative mortality of 11.1% was recorded (4/36 minipigs). Seven animals (19.4%) developed ventricular fibrillation during coronary occlusion, anticipated in six cases by marked S-T segment changes, and underwent CPR and electrical external defibrillation (43% success). No minipigs surviving the procedure died within the next 72 hours. Two animals needed intra-operative cardioversion. Intraoperative nociception was recorded during the reperfusion phase in six animals (16.6%), and post-operative pain in four, which had previously shown intra-operative nociception. Intra-operative arrhythmias were recorded in 31 animals and needed treatment in 16 (51.6%). Seven minipigs were diagnosed with post-operative arrhythmias at rest, being sinus bradycardia the most represented (4/7), which resolved within 24 hours.

Myocardial infarction induction brings about high risk of intraoperative fatal arrhythmia. Non-fatal arrhythmias have a good post-operative prognosis.

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## Profile identification of brazilian anesthesists

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This is the first survey conducted on the anesthetic practices of brazilian veterinarians.

An online questionnaire (CEP/UFRPE No. 4.670.086) was applied to licensed veterinarians, consisting of 34 questions about perianesthetic management in dogs and cats, considering three biases: gender, region of practice (Southeast, Center-West, North, South, and Northeast), and level of professional development (residency and/or specialization; master's and/or PhD; no further training). Descriptive statistics were applied to each question, followed by Chi-square or Fisher's exact test ($p < 0.05$) to assess associations between qualitative variables.

The response rate was 80% (418 out of 473 professionals completed all questions). There was a statistically significant difference among professionals from different regions regarding the use of equipment such as basic monitors and capnographs, with lower usage in the North (OR = 0.29; 95% CI: 0.11 – 0.76) compared to the Southeast. In pre anesthetic medication, acepromazine was one of the most used drugs (358/418; 85.6%). However, tramadol (OR = 5.47; 95% CI: 2.91 – 10.28) was more frequently used in the Northeast, while dexmedetomidine was more commonly used in the South (OR = 2.03; 95% CI: 1.16 – 3.56). Propofol for anesthetic maintenance was more frequently used in the South compared to other regions (OR = 1.80; 95% CI: 1.09 – 2.98). Women were more likely to use monitoring equipment and assess clinical parameters such as palpebral reflex ($\chi2 = 10.73$, $p = 0.001$) during anesthesia than men. Academic training (master's/PhD) was associated with the use of safer equipment such as infusion pumps (OR = 14.04; 95% CI: 5.04 – 39.10), and the use of reversal agents like atipamezole (OR = 17.73; 95% CI: 3.82 – 82.30).

The survey reflected the actual practices of these professionals and their total or partial adherence to the latest veterinary anesthesia guidelines, particularly among women in the Southeast region with academic training.

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## 5365Enflicoxib for postoperative pain and inflammation in orthopaedic surgery. A multicentre, randomised, non-inferiority, blind clinical trial.

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Enflicoxib has been recently approved in the EU to treat postoperative pain and inflammation. This study evaluated the safety and efficacy of a single dose of enflicoxib compared to daily firocoxib in dogs undergoing orthopaedic surgery.

A total of 216 dogs were randomly assigned to receive 8 mg $kg^{-1}$ enflicoxib (Daxocox®, Ecuphar/Animalcare) the day before surgery or 5 mg $kg^{-1}$ firocoxib (Previcox®, Boehringer Ingelheim) -2h, and daily for 7 days. All animals received intraoperative analgesia with dexmedetomidine and, optionally, fentanyl. Efficacy was measured using the Short-Form Glasgow Composite Pain Scale (SF-GCPS) at different time points (2, 5, 8, 24 hours, and 2, 3, 5, and 7 days) post-surgery. Inflammation was assessed using a Visual Analog Scale (VAS), and owners evaluated the response to treatment (ORTT) based on demeanour, analgesic effect, and mobility. The primary efficacy outcome was the SF-GCPS total scores area

under the curve for the first 48 hours (SF-GCPS AUC2-48h), analysed with a non-inferiority t-test at 5% one-sided significance. Safety was evaluated by the incidence of adverse events and blood and urine analysis.

Enflicoxib demonstrated non-inferiority to firocoxib in SF-GCPS AUC2-48h [119.17 ± 75.25 (95% CI 104.68, 133.66) vs 124.83 ± 78.21 (95% CI 109.77, 139.89) with a difference of -5.66 ($p = 0.002$, 95% CI $-\infty$, 11.75)]. No significant differences were detected in the SF-GCPS total scores at each time point, ORTT, and safety observations. Inflammation scores were significantly lower for enflicoxib for the first 3 timepoints ($p < 0,05$).

In conclusion, a single dose of enflicoxib is a safe and effective alternative for managing postoperative pain and inflammation for up to seven days following orthopaedic surgery in dogs.